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NATIONAL DAM SAFETY PROGRAM. MEMPHIS LAKE AND PARK DAM (MO 1021--ETC(U)
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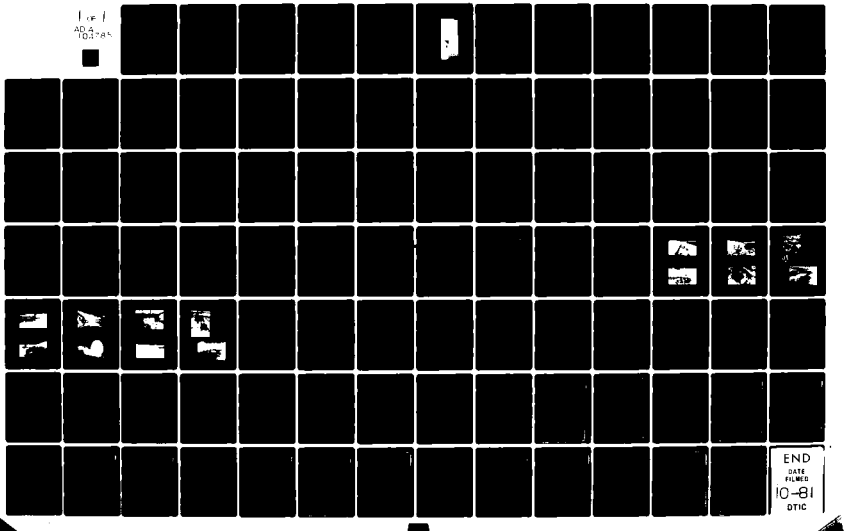


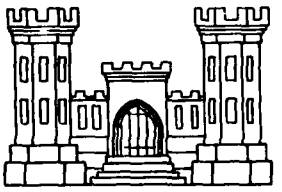
MISSISSIPPI - SALT - QUINCY RIVER BASIN

MEMPHIS LAKE AND PARK DAM

SCOTLAND COUNTY, MISSOURI

MO 10217

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1978

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Memphis Lake and Park Dam (Mo. 10217),
Phase I Inspection Report

This report presents the results of field inspection and evaluation of Memphis Lake and Park Dam (Mo. 10217). It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

29 DEC 1978
(Date)

APPROVED BY: SIGNED
Colonel, CE, District Engineer

29 DEC 1978
(Date)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Memphis Lake and Park Dam, Inv. No. 10217
State Located:	Missouri
County Located:	Scotland
Stream:	Tributary of the North Fabius River
Date of Inspection:	September 28, and October 5, 1978

Memphis Lake and Park Dam No. Mo. 10217 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

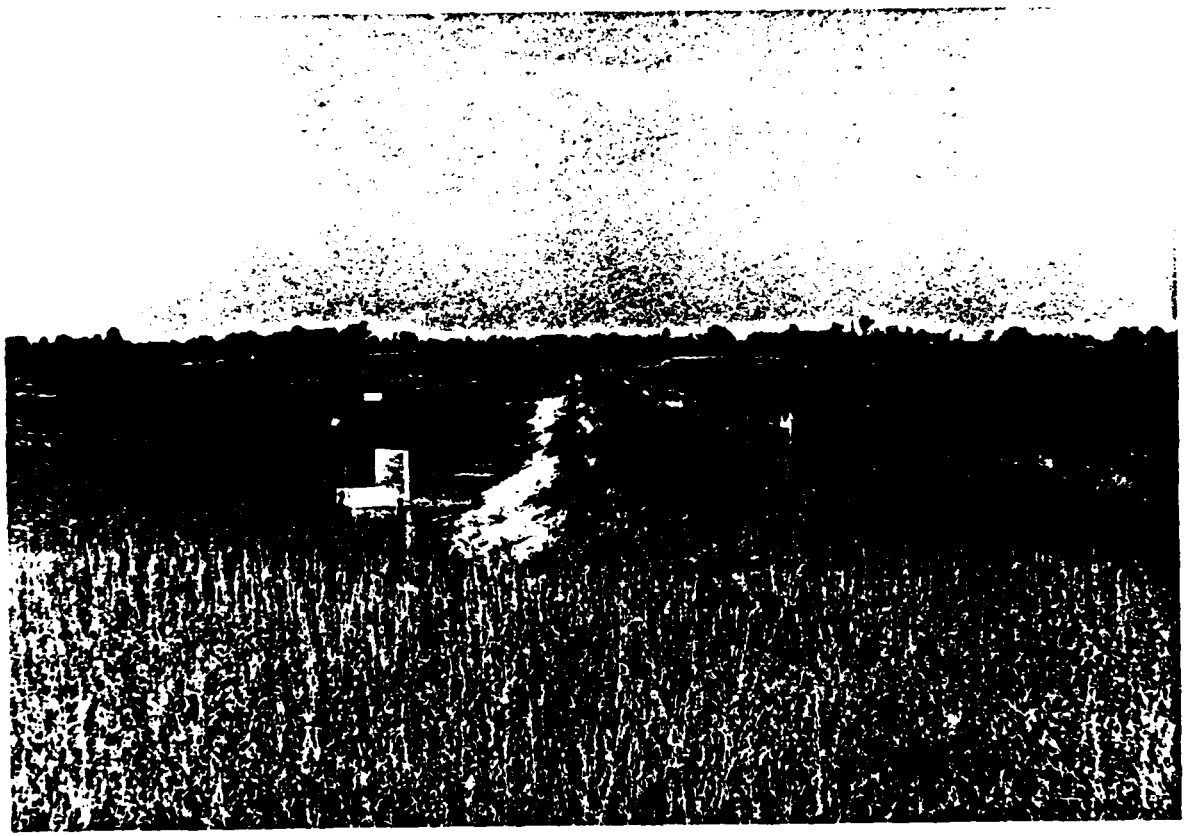
Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Three farmhouses with associated farm buildings, the Scotland County Fairgrounds and associated buildings, one highway bridge, and one improved road would be subjected to flooding with possible damage and/or destruction, and possible loss of life. Memphis Lake and Park Dam is in the intermediate size classification since it is more than 40 feet, but less than 100 feet high, and impounds more than 1,000 acre-feet but less than 50,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Memphis Lake and Park Dam meets the criteria set forth in the guidelines for a dam having the above size and hazard potential. Memphis Lake and Park Dam is an intermediate size dam with a high hazard potential required by the guidelines to pass the Probable Maximum Flood without overtopping. It was determined that the spillway will pass greater than 100 percent of the Probable Maximum Flood without overtopping the dam. Also, our evaluation indicates that the spillway will pass the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were a need for an annual inspection by a qualified professional engineer; lack of a maintenance schedule; surface erosion gullies at the abutment contacts; seepage downstream of the toe of the dam; need for a trashrack over the drop inlet of the service spillway; and the buried discharge end of the low level outlet. The lack of stability and seepage analysis on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.



MEMPHIS LAKE AND PARK DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Memphis Lake and Park Dam, I.D. No. 10217

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NATIONAL DAM SAFETY PROGRAM

MEMPHIS LAKE AND PARK DAM, Missouri Inv. No. 10217

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for the Memphis Lake and Park Dam was carried out under Contract DACW 43-78-C-0160 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of the Memphis Lake and Park Dam was made on September 28, and October 5, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The dam embankment is a zoned earthfill structure. The crest of the embankment has a width of 10 feet and a length of approximately 1,635 feet. The crest elevation is set at 780.0 feet above MSL, and the maximum height of the embankment is 70 feet above the minimum streambed elevation.

The upstream and downstream slope of the typical embankment section is constructed with a 1V to 2-1/2H slope from the crest to elevation 760.0, a 1V to 4H slope from elevation 760.0 to elevation 744.0, a 1V to 10H slope from elevation 744.0 to elevation 740.0, and a 1V to 2-1/2H slope to the ground surface. The central core zone (zone "A") of the embankment section has a top width of 5 feet at elevation 780.0, and side slopes of 1V to 1H upstream and 3/4V to 1H downstream. The shell zones (zone "B") are located upstream and downstream of the core zone and are placed from the crest to elevation 744.0, where they have a slope of 1V to 1-1/2H to the ground surface. Supporting berms (zone "C" material) are located at the upstream and downstream ends of the embankment.

The material used for the various zones are described in the contract specifications as follows:

1. Zone "A": Materials suitable for use in Zone "A", within the limits shown on the drawings, shall consist of inorganic silts and clays of medium to high plasticity classified as CL or CH soils in the Unified Soils Classification Chart, revised 1960. This soil is capable of being compacted into a dense, impervious, stiff soil

mass. The soil shall be free of plant growth, roots, and humus. Rock fragments shall be not more than 15 percent of the total dry weight of soil, and shall be small enough to be incorporated in a 6-inch compacted lift. Rock fragments exceeding 6 inches in the maximum dimension shall be removed and incorporated in Zone "C".

2. Zone "B": Materials suitable for use in Zone "B" shall be of a random nature which may consist of any combination of impervious or pervious materials, but shall be free of plant growth, roots and humus. Pervious materials consist generally of sands and gravels having correspondingly higher permeability than the impervious material. Rock fragments exceeding six (6) inches in the maximum dimension shall be removed and incorporated in Zone "C".

3. Zone "C": Material for use in Zone "C", within the limits shown on the drawings, may be of a nature that is unacceptable for Zones "A" or "B", but not to contain soil with high concentration of organic material, or other unwanted materials. Shale and rock from required excavations may be incorporated in Zone "C" except that large concentration or defined layers of shale shall not be permitted.

A 24-inch thick layer of dumped riprap and filter blanket material was placed on the upstream embankment slope from elevation 760.0 to 773.0 for protection. The riprap was found to consist of angular blocks of limestone up to 2 feet in diameter. Most of the blocks were 6-inches to 1-foot in diameter.

Bedrock within the vicinity is composed of Pennsylvania age cyclic deposits of sandstones and shales. No rock crops out over the site. The soils of the area in which this dam is located are considered to be mixed glacial outwash modified with loessial deposits further modified by weathering.

A cut-off trench, with side slopes of 1H to 1V, and a base width of 10 feet, was excavated upstream of, and parallel to, the dam axis. Through the abutments, this trench was excavated to a depth of at least 5 feet into the foundation, and through the channel section the trench penetrated the foundation and was founded in the impervious materials.

There are two spillways for the Memphis Lake and Park Reservoir. The service spillway is located about 300 feet from the right end of the dam embankment. The spillway consists of a concrete drop box inlet structure which connects to a 60-inch C.M.P. under the embankment. The 60-inch C.M.P. is about 350 feet in length with a 10.6% slope. A 36 foot wide by 77 foot long trapezoidal shape stilling basin is located at the spillway outlet. The normal reservoir pool elevation and the elevation of the spillway crest is 770.0.

The emergency spillway is a cut section which is located near the right abutment approximately 200 feet from the end of the dam embankment. The spillway is a grass-lined open channel with side slopes of 1V to 3H, and a bottom width of 250 feet.

The inlet structure of the service spillway has an auxiliary gated outlet built into it. This auxiliary outlet is 18 inches in diameter with its invert 9 feet below the service spillway crest. The gate is mounted on the upstream face of the inlet structure wall and is operated by a hand-wheel and removable stem extension which projects above the spillway crest. The gate discharges directly into the 5-foot diameter spillway conduit. The gate is cast iron with non-rising stem and of standard commercial design manufactured by Armco Steel Corporation.

The project plans show a low level outlet pipe with inlet elevation at 733.0 (reservoir bottom), and discharge at El. 718.0. The pipe is 12-inch ductile iron. The intake control is a 12-inch diameter iron body mud valve operable only by a diver.

The intake is protected by a steel dished head which is positioned to serve as a shield over the inlet port of the mud valve. At the downstream end of the outlet pipe, the plans show control by a buried 12-inch gate valve. Immediately upstream of the gate valve, the plans show an 8-inch branch with gate valve which is plugged - apparently intended for future connection. The pipe outlet is shown to discharge into a riprap protected channel leading to the streambed downstream.

A 12-inch ductile iron pipe outlet passes beneath the embankment near the left abutment. The inlet to this pipe, at El. 750.5, is at the base of a 22-foot intake tower which is fitted with 12-inch diameter inlet ports at three different elevations to control the water temperature and quality. The tower is of concrete, and 6-foot square in plan. Each of the three inlet ports is controlled by a

12-inch gate valve and is fitted with a trash screen. The lowest of these ports is at El. 755.0 feet. The valves are operable from the deck of the tower by extension stems provided with nuts for removable handwheels. The tower can be reach only by boat.

Apparently, the tower was constructed as a contingency for water supply, since there is no evidence or information on its actually being connected to a water supply system, nor is information available as to its discharge location.

b. Location

The Memphis Lake and Park Dam is located upstream of the Old Memphis Lake Reservoir, which lies on an unnamed tributary of the North Fabius River, Scotland County, Missouri. The nearest downstream community is Memphis, itself, population 2,081, which is approximately 3 miles from the lake. The dam and reservoir is shown on the Memphis Quadrangle Sheets (7.5 minute series) in Section 14, Township 65 North, Range 12 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Intermediate" since its storage is more than 1,000 acre-feet, but less than 50,000 acre-feet. The dam is also classified as "Intermediate" in dam size category because its height is more than 40 feet, but less than 100 feet. The overall size classification is, accordingly, "Intermediate" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. The estimated damage zone extends 12 miles downstream of the dam. Memphis Reservoir (10163) is approximately one-half mile downstream of Memphis Lake and Park Dam. Also within the damage zone are three farmhouses with associated farm buildings, the Scotland County Fairgrounds and associated buildings, one highway bridge, and one improved road bridge. The floodplain is extensively farmed.

e. Ownership

Memphis Lake and Park Dam is owned by the City of Memphis, 135 South Main Street, Memphis, Missouri 63555.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational use in a recreational system operated by the City of Memphis, and as back-up water supply for the city.

g. Design and Construction History

Memphis Lake and Park Dam was designed by Wm. Riddle Engineering Company of Kansas City, Missouri in 1973. Initial construction of the dam was started by C. D. Dunn & Small Construction of Memphis, Missouri, but they were unable to complete the project. The construction was

finished by Hardys, Inc., of Shelbyville, Missouri. No reconstruction has been performed since the original construction.

h. Normal Operational Procedures

The dam is used to impound water for use as water supply and for recreation. The reservoir level is controlled by rainfall, runoff, evaporation, and the water supply requirements of the City of Memphis, Missouri. The reservoir will likely be close to full at all times.

1.3 Pertinent Data

a.	Drainage Area	1,950 acres
b.	Discharge at Damsite	All discharge at the damsite is through two uncontrolled spillways with an 18-inch cast iron gate in the service spillway shaft, a low level outlet conduit, and a water supply system
Estimated experienced maximum flood:		0 cfs
Estimated ungated spillway capacity at maximum pool elevation:		7,565 cfs

c. Elevation (Feet above MSL)

Top of dam:	780.0
Spillway crest: (Service spillway)	770.0
(Emergency spillway)	774.0
Minimum streambed elevation at centerline of dam:	710.0
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool:	8,600 feet ±

e. Storage (Acre-Feet)

Top of dam (from 1974 inventory):	7,030
Spillway crest: (Service spillway)	5,164
(Emergency spillway)	4,109

f. Reservoir Surface (Acres)

Top of dam (interpolated value):	342
Spillway crest:	248

g. Dam

Type:	Zoned earth embankment
Length:	1,635 feet
Height (maximum):	70 feet
Top width:	10 feet
Side slopes:	
Downstream	1V to 2-1/2H for top 20 feet 1V to 4H for next 16 feet 1V to 10H for next 4 feet 1V to 2-1/2H to ground surface
Upstream	Same
Zoning:	Three - core, shells and stabilization berms
Impervious core:	5-foot top width with 1V to 1H upstream slope and 3/4V to 1H downstream slope
Cutoff:	Core trench with 10-foot bottom width and 1V to 1H side slopes
Grout curtain:	None

h. Diversion and Regulating Tunnel None

i. Spillway

Type:	(Service spillway)	Uncontrolled
	(Emergency spillway)	Uncontrolled
Length of weir:	(Service spillway)	25 feet
	(Emergency spillway)	250 feet
Crest Elevation:	(Service spillway)	770 feet
	(Emergency spillway)	774 feet

j. Regulating Outlets

Type:	18-inch sluice gate discharging into service spillway conduit
Length:	350 feet
Closure:	18-inch sluice gate
Maximum Capacity:	30 cfs

Type:	12-inch diameter ductile iron low level outlet pipe
Length:	420 feet
Closure:	Mud valve at upstream end and gate valve at downstream end
Maximum Capacity:	$\pm$ 25 cfs

Type:	12-inch diameter ductile iron water supply outlet
Length:	Unknown
Closure:	Gate valve at upstream end
Maximum Capacity:	Unknown

SECTION 2: ENGINEERING DATA

2.1 Design

Original design drawings are available for the dam and appurtenant structures. These drawings were made and approved in 1973, and are given as plates in this report. Also available are design calculations for the spillway, and bore hole logs of sampling performed in the foundation and borrow areas.

Design data is available from the City of Memphis, Missouri and/or William G. Riddle and Associates, 3947 State Line Road, Kansas City, Missouri 64111.

2.2 Construction

The dam was constructed in 1973 and 1974. Specifications for construction are available, and a report written by the design engineer concerning an inspection made during construction. Construction data is available at locations described in Section 2.1.

2.3 Operation

No operation records for Memphis Lake and Park Dam are available.

2.4 Evaluation

a. Availability

The availability of data is considered good for this project. Complete design drawings and specifications are available, along with some design calculations and soil testing results.

b. Adequacy

The engineering data available is adequate to aid in evaluating the adequacy of the hydraulic and hydrologic capabilities and stability of the dam for Phase I investigations.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

The dam and appurtenant structures appear to be constructed in accordance with available design drawings. The drawings show a pipe support and discharge channel for the outlet conduit, however, the support nor outlet end of the conduit was not seen during the field inspection. It is likely this structure was buried during construction and would have to be uncovered to be used.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of Memphis Lake and Park Dam was made on September 28, and October 5, 1978. The following persons were present during the inspection:

Name	Affiliation	Discipline
Yin Au-Yeung	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
David Bramwell	Engineering Consultants, Inc.	Geology
Jon Diebel	Engineering Consultants, Inc.	Soils
John Ismert	Engineering Consultants, Inc.	Mechanical
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil & Structural

Specific observations are discussed below.

b. Dam

The crest of the dam has a heavy vegetative cover which adequately protects the embankment material. The grass was long at the time of inspection, indicating it had not been recently cut. No significant deviations in vertical or horizontal alignment were apparent.

The upstream embankment slope is adequately protected by the riprap described earlier. No degradation due to weathering of the blocks was seen. The riprap appears to be smaller than desirable, but no significant settlement or sloughing of the rock was observed during the inspection. The upstream slope above the riprap limit of the riprap is adequately protected by heavy vegetative cover.

The downstream embankment slope is covered with heavy grass vegetation. Along each abutment contact are relatively large surface erosion gullies. Some of these gullies are 3 to 4 feet deep by 2 feet wide. These gullies are very large for a dam as new as this structure, and repairs should be made to reduce the erosion.

Downstream of the toe of the dam embankment, several moist areas with ponding water were observed. However, the cause of this moisture could be due to recent rainfall in the vicinity of the damsite. At one 50 square foot area just downstream of the toe of the dam and approximately 500 feet south of the left abutment, phreatophytes are present with the moist condition, indicating the probability of seepage. This condition does not appear serious at this time, but the area should be monitored for changes in the quantity, location or color of the seepage flow.

No signs of past or present instability was seen on the embankment or in the foundation at any location.

c. Appurtenant Structures

(1) Spillways

The concrete drop inlet structure is in excellent condition with the exception that there are no provisions for trashracks on the concrete crest. No evidence of structural cracking or spalling could be found. No leakage in the 60-inch C.M.P. was detected. The stilling basin at the end of the 60-inch C.M.P. is also in a good condition, with adequate riprap protection.

The emergency spillway is adequately maintained with no indication of instability on the slopes.

(2) Outlet Works

The gate controlling the auxiliary outlet in the service spillway was closed at the time of inspection permitting observation of its downstream face. The gate is in good condition and seals tightly. The extension stem and handwheel were removed. Condition of the lifting stem and threads could not be checked since they were submerged.

The top of the tower for the water supply outlet was visible. It was observed to be in good and essentially "new" condition. The discharge end of the pipe was not found.

The existence of a low level outlet was confirmed by the Memphis City Clerk who reported it had been used from time to time to supply water to a downstream reservoir. Attempts to uncover, or even locate, the 12-inch pipe outlet or the outlet channel, however, were unsuccessful.

d. Reservoir Area

The water surface elevation was 766.5 on the day of the inspection.

The reservoir rim is gently sloped and no indications of instability or severe erosion were readily apparent. The slopes above the reservoir are heavily grassed. No buildings or dwellings are built on or near the shoreline.

e. Downstream Channel

The downstream channel is well-defined, with some vegetative and tree growth immediately downstream of the stilling basin. No major obstacles or debris were observed along the downstream channel. Only very minor erosion could be observed in a few areas.

3.2 Evaluation

The visual inspection did not exhibit any items which are sufficiently significant to indicate a need for immediate remedial action.

The following items were observed which could affect the safety of the dam or which will require maintenance within a reasonable period of time.

1. Surface erosion which is forming gullies on each abutment contact.

2. A seepage area located downstream of the toe of the dam approximately 500 feet from the left abutment.

3. The service spillway drop inlet crest was not provided with a trashrack.

4. The discharge end of the low level outlet and the water supply outlet are apparently buried.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The dam is used to impound water for use as water supply and recreation. The reservoir is located on an unnamed tributary of the North Fabius River, just upstream of Memphis Reservoir.

The operating facilities at the dam include a low level drain line, a slide gate located on the service spillway intake structure, and a water supply intake. These outlets can be used to either lower the reservoir for maintenance, or make releases downstream to the Memphis Reservoir.

4.2 Maintenance of Dam

The dam is maintained by the City of Memphis, Missouri. Maintenance appears to be satisfactory at the pesent time. The erosion gullies at the abutment contacts should be repaired in the near future.

4.3 Maintenance of Operating Facilities

The discharge end of the low level drain line and the water supply outlet should be uncovered. The remainder of the operating facilities appear to be adequately maintained.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system for this dam.

4.5 Evaluation

No problems were found with the operation procedures and maintenance program at the damsite. The erosion gullies and the buried discharge end of the drain line and water supply outlet should be uncovered in the near future.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Memphis Lake and Park Dam upstream from the dam axis consists of approximately 834 acres, with only 2 to 3 percent being covered by trees and forest. Land gradients in the higher regions of the watershed average roughly 3 percent, and in the lower areas surrounding the reservoir average about 4 percent. The new Memphis Lake Reservoir is located about one-half mile upstream of the old Memphis Reservoir, which also lies on a tributary of the North Fabius River. At its longest arm, the watershed area is approximately 2.3 miles long. A drainage map showing the watershed area is included in Appendix B.

Evaluation of the hydraulic and hydrologic features of Memphis Lake and Park Dam was based on criteria set forth in the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph. The derived unit hydrograph is presented in Appendix B.

Initial and infiltration loss rates were applied to the PMP to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF hydrograph, utilizing the Corps of Engineers' computer program HEC-1, (Dam Safety Version), which was prepared specifically for dam safety analysis. The computed peak discharge of the PMF and one-half of the PMF are 26,290 cfs and 13,145 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. The peak outflow discharges for the PMF and one-half of the PMF are 9,701 cfs and 2,634 cfs, respectively. Both the PMF and one-half of the PMF, when routed through the reservoir, can safely pass through the spillways without overtopping of the dam. The hydraulic capacity of the spillways when water level is at the top of the dam is 12,400 cfs.

The stage-outflow relation for the spillway was prepared from field notes, sketches and limited construction drawings. The reservoir stage-capacity data were based on the U.S.G.S. Memphis Quadrangle topographic maps (7.5 minute series) in combination with data given in the National Dam Safety Inventory Table. In the routing computations, the discharge through the outlet facilities was excluded due to its insignificant magnitude as compared to the spillway discharge and the PMF. The combined spillways and overtop rating curve (service spillway plus emergency spillway) and the reservoir capacity curve are also presented in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest will erode the dam face and, if continued long enough, will breach the dam embankment and release all the stored water suddenly into the downstream floodplain. The safe hydrologic design of a dam calls for a spillway discharge capability, in combination with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineers designs its dams to safely pass the Probable Maximum Flood that is estimated could be generated from the upstream watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. According to the Corps criteria, the hydrologic requirement for safety for this dam is the capability to pass the Probable Maximum Flood without overtopping.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to the owner, the maximum reservoir level has yet to fill up the the service spillway crest.

c. Visual Observations

Both the service spillway and the emergency spillway are well-defined and in good condition. The reservoir is the approach channel to the spillways. The stilling basin of the service spillway is also in good condition, with adequate riprap in the basin floor and slopes. Some vegetative growth

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement or distress observed on the embankment or foundation during the visual inspection. The upstream slope, crest, and downstream slope are well protected by either riprap or vegetation. The seepage observed, at its current condition, is not felt to be sufficiently serious to indicate an unsafe condition. However, the seepage should be monitored and any changes in quantity, location or color should be reported and investigated.

The surface erosion gullies should be repaired within a reasonable period of time to prevent the removal of large amounts of embankment material.

Neither the service spillway drop inlet nor the 60-inch C.M.P. discharge pipe exhibited any evidence of misalignment or structural instability. There are no signs of local slides or slumps on the emergency spillway slopes. The spillways were found to be structurally stable in all aspects.

The discharge ends of the low level outlet and the water supply outlet should be uncovered.

b. Design and Construction Data

Design data giving test hole logs of foundation and borrow area soil sampling are available. Also, the specifications providing requirements for construction of the dam and appurtenant structures is available. No design data relating to seepage and stability analysis are known to exist.

c. Operating Records

No operating records are available relating to the stability of the dam. Water level on the day of inspection was 3.5 feet below the crest of the service spillway, and it is assumed that the reservoir remains close to full at all times. The operating facilities at the dam includes a water supply intake and appurtenant piping, a low level outlet conduit and intake, and a slide gate on the service spillway structure. The inspection team knows of no problems with operation of any of these facilities.

d. Post Construction Changes

No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability

In general, projects located in Seismic Zones 0 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Memphis Lake and Park Dam is located in Seismic Zone 1. A detailed seismic analysis is not felt to be necessary for this embankment.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Memphis Lake and Park Dam was found to be adequate to pass the PMF without overtopping the embankment. Other items observed during the inspection which should be repaired within a reasonable period of time, or monitored, include:

1. Surface erosion gullies at each abutment contact.

2. Seepage located downstream of the toe of the dam approximately 500 feet south of the left abutment.

3. The service spillway drop inlet was not provided with a trashrack.

4. The buried discharge ends of the low level outlet and the water supply outlet should be uncovered.

b. Adequacy of Information

Information concerning operation and maintenance of the dam and appurtenant structures is somewhat lacking. It is recommended that the following programs be initiated to help alleviate this problem:

1. Annual inspection of the dam by a professional engineer experienced in the design and constrution of earthen dams should be made and this inspection report made a matter of record.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Perform seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

The engineering data, together with performance history and visual inspection findings, is felt to be adequate information to support the conclusions presented in this report.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

The owner should initiate the following programs:

1. Annual inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Repair the surface erosion gullies.

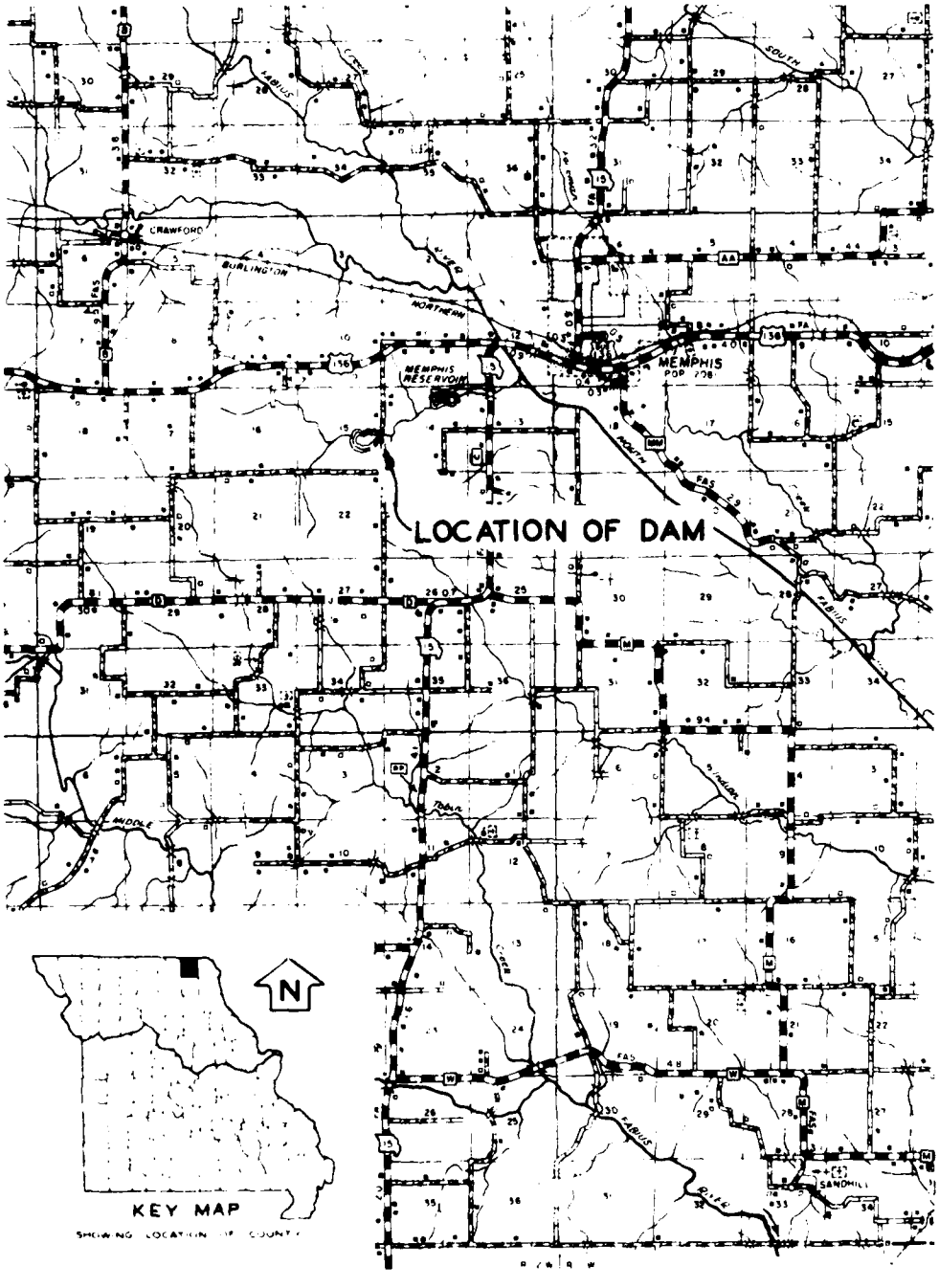
4. Monitor the seepage downstream of the toe of the dam approximately 500 feet south of the left abutment for changes in quantity, location or color, and report any changes.

5. Provide a trashrack over the drop inlet of the service spillway.

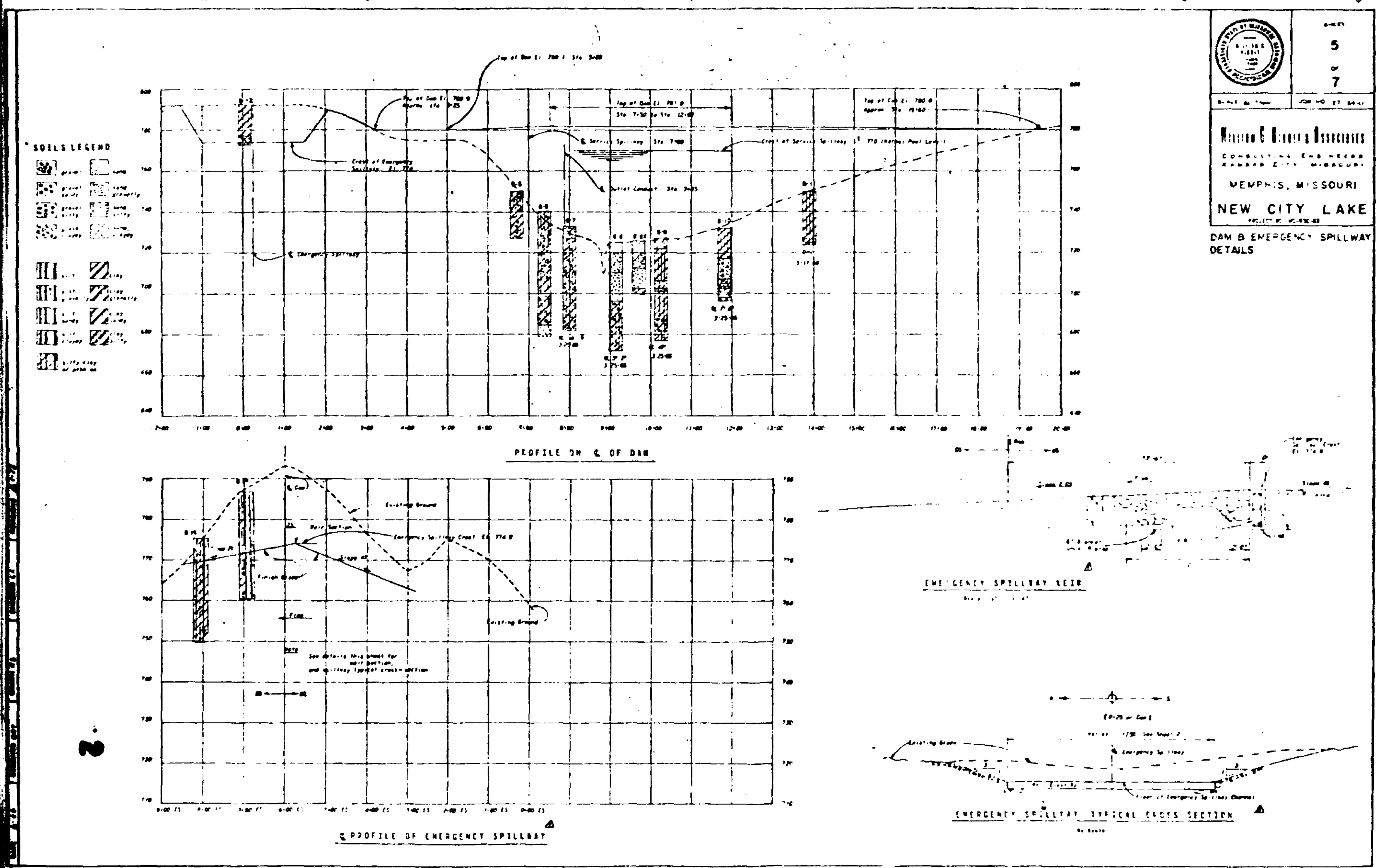
6. Uncover the buried discharge ends of the low level outlet and the water supply outlet.

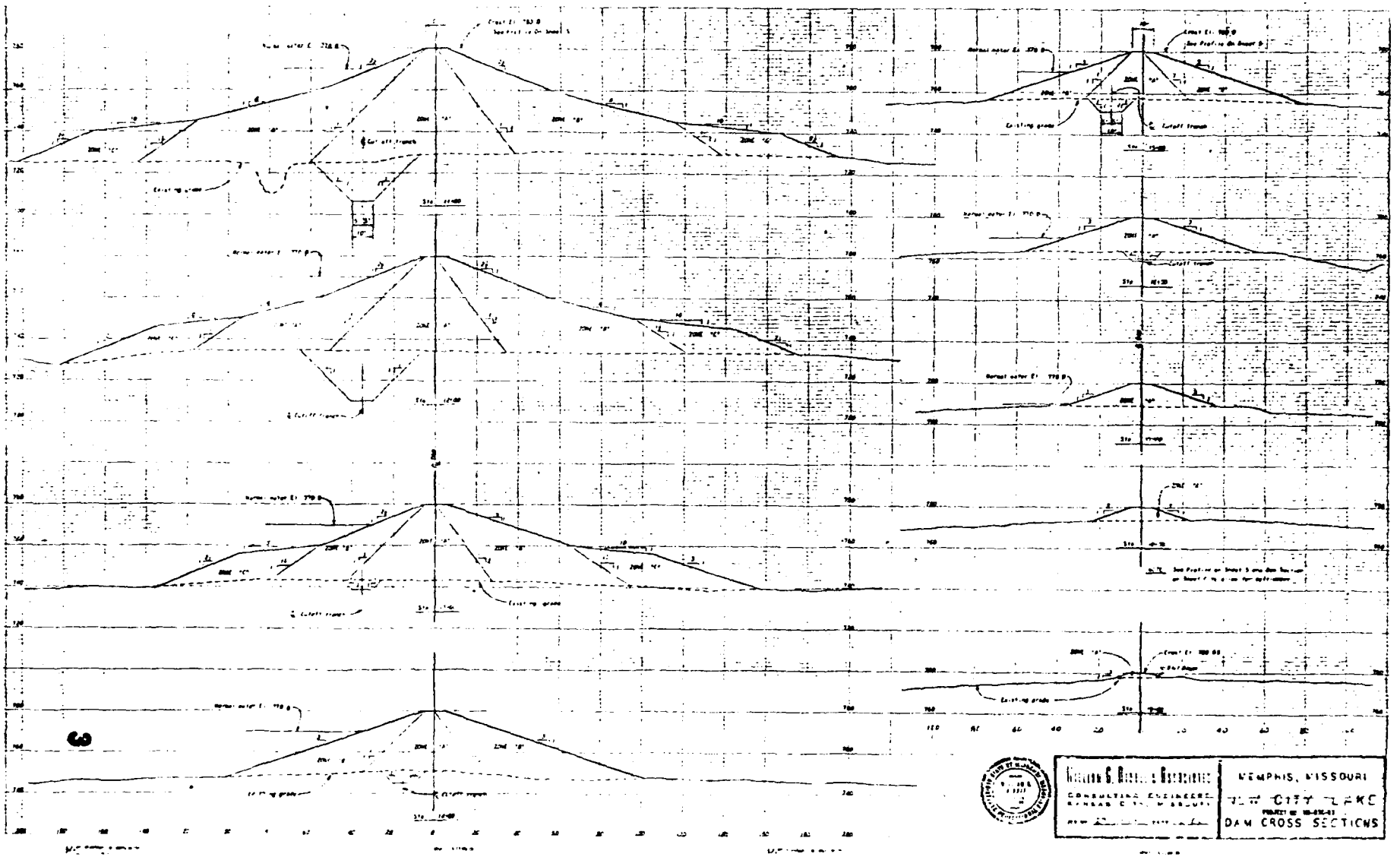
7. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

PLATES

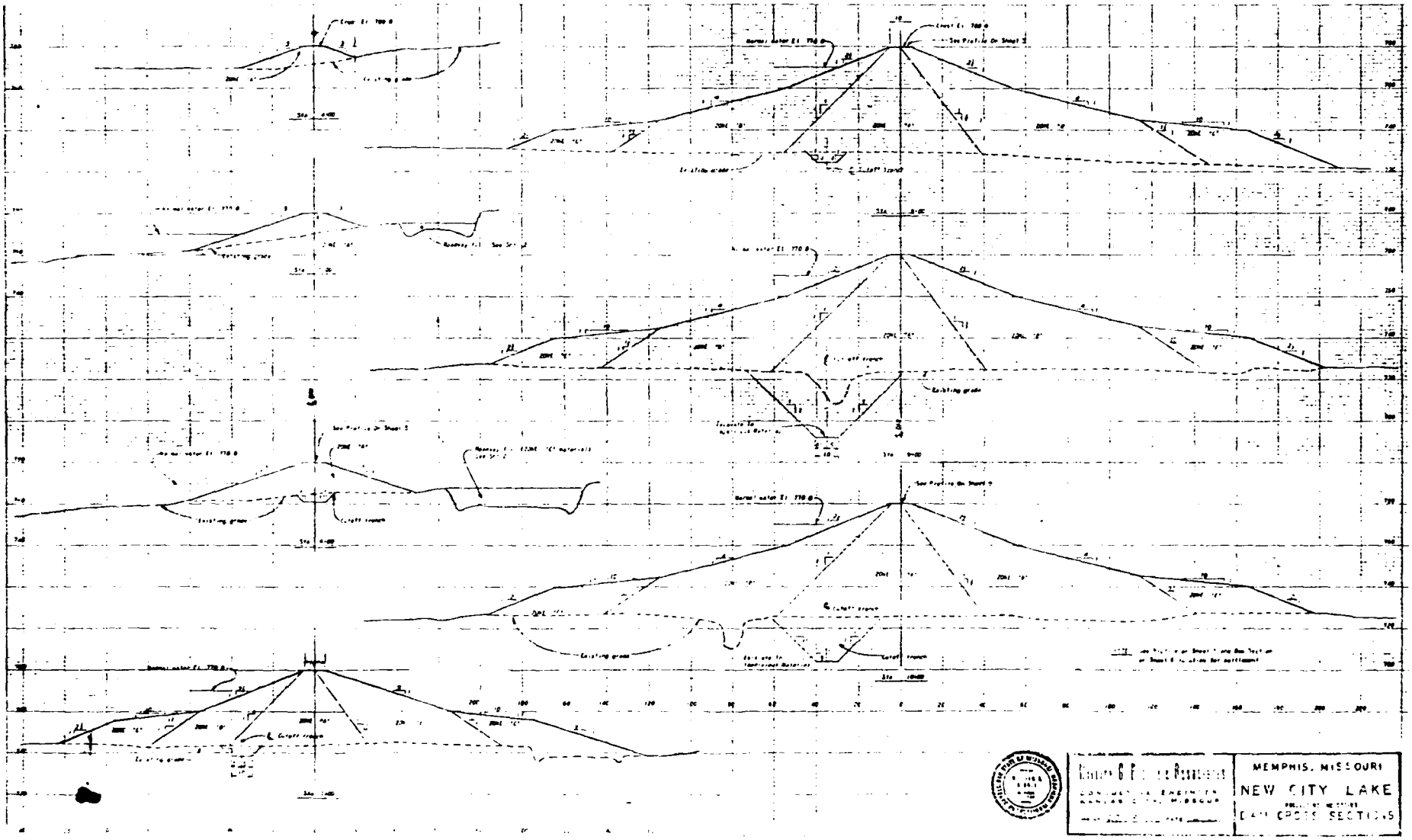


LOCATION MAP
MEMPHIS LAKE AND PARK DAM
SCOTLAND COUNTY, MISSOURI


SOILS LEGEND
PROFILE ON ℄ OF DAM
℄ PROFILE OF EMERGENCY SPILLWAY
EMERGENCY SPILLWAY WEIR
EMERGENCY SPILLWAY TYPICAL CROSS SECTION
Existing Ground
Crest of Emergency Spillway
℄ Emergency Spillway
Outlet Conduit
MEMPHIS, MISSOURI
NEW CITY LAKE
DAM B EMERGENCY SPILLWAY
DETAILS
SHEET 5 OF 7



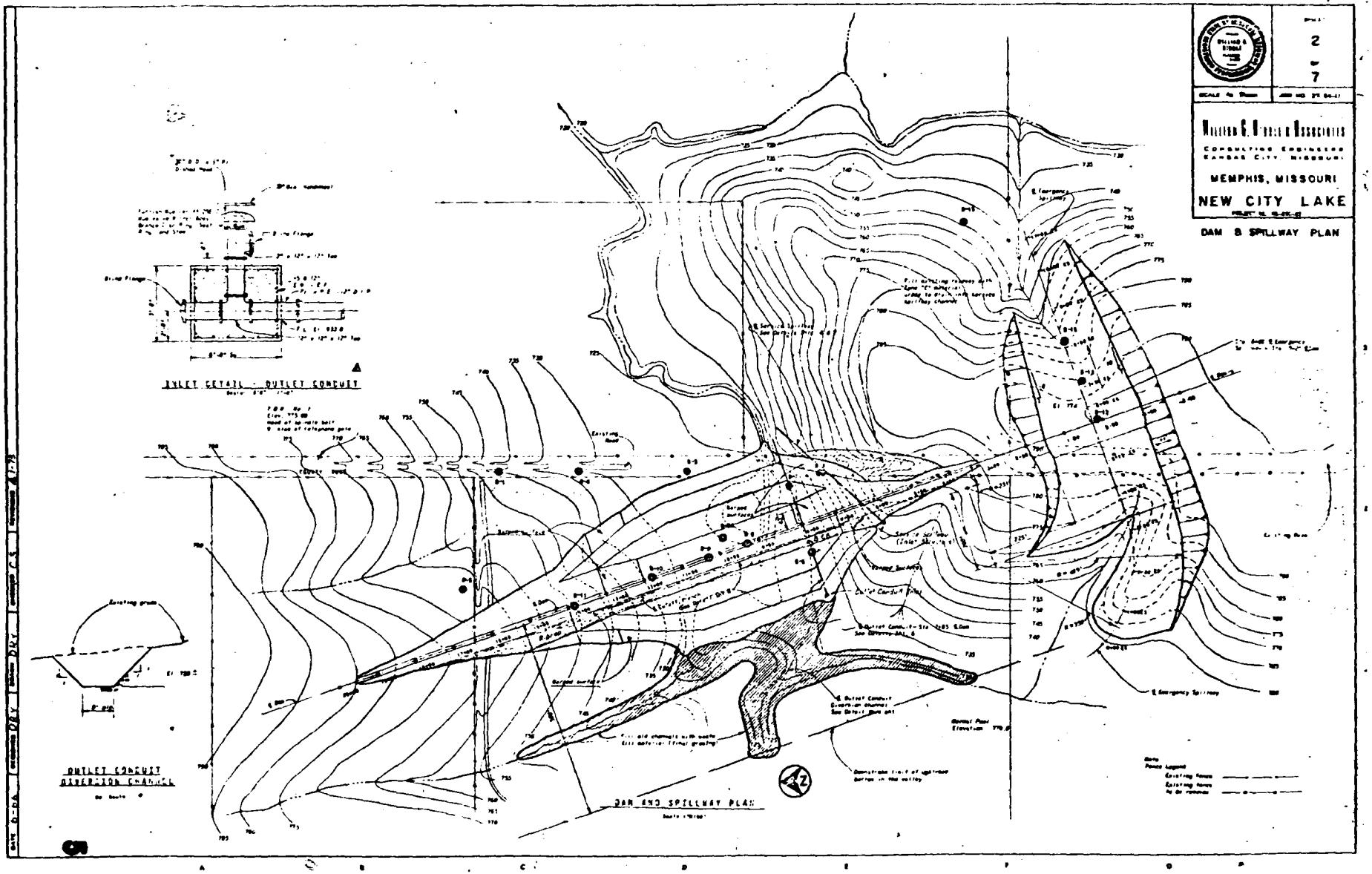
MEMPHIS, MISSOURI
CITY LAKE
DAM CROSS SECTIONS

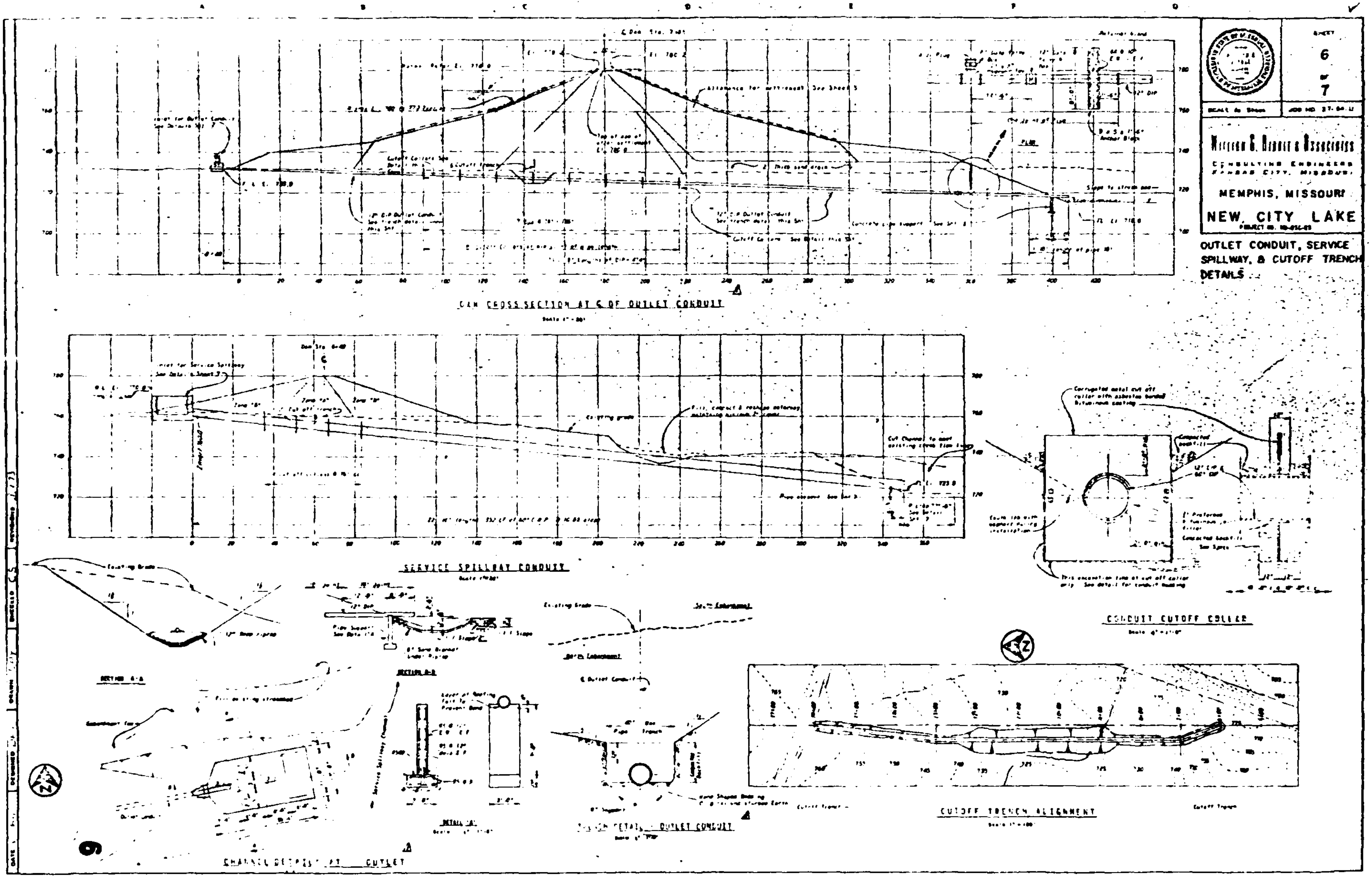


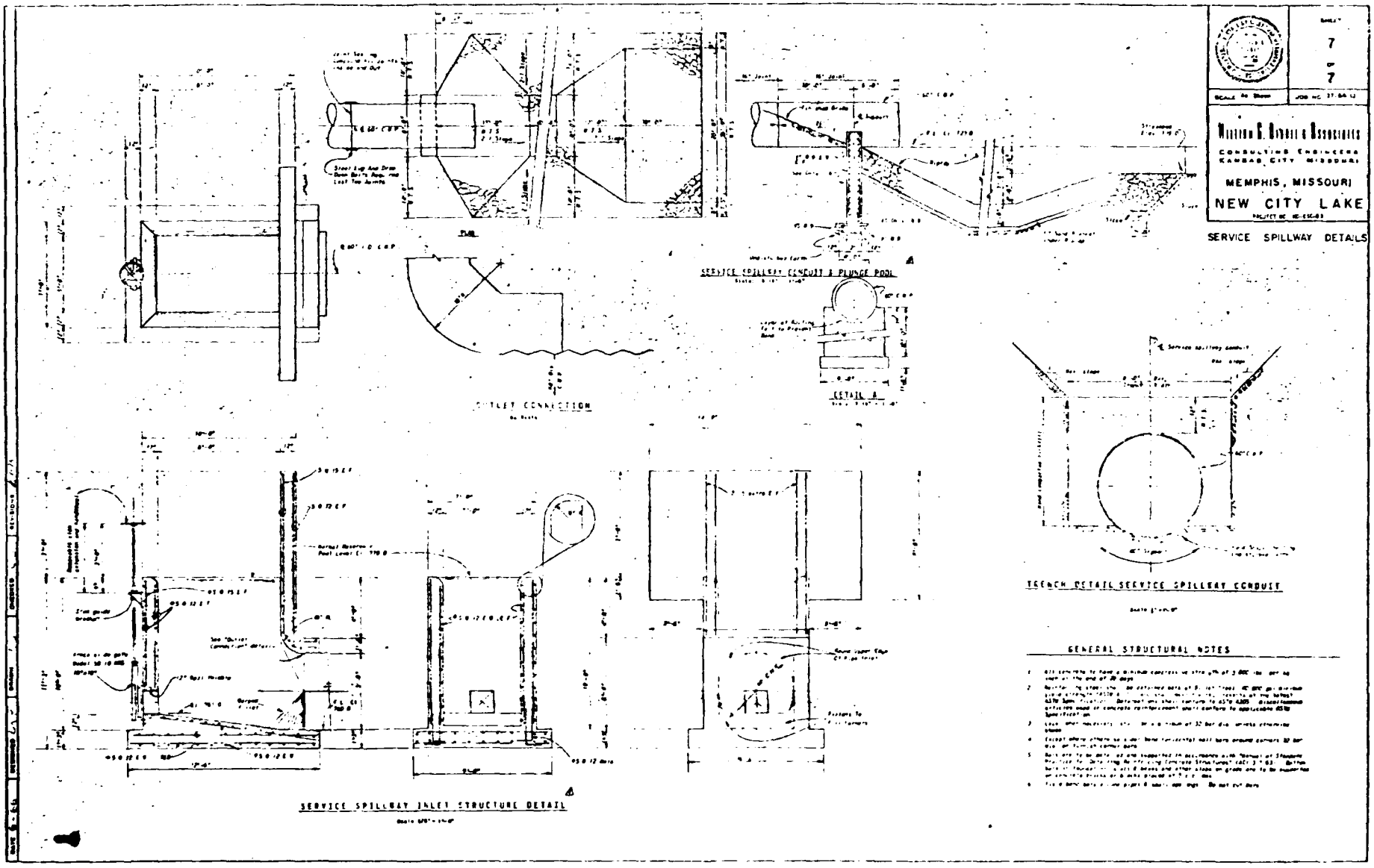
MEMPHIS, MISSOURI

NEW CITY LAKE

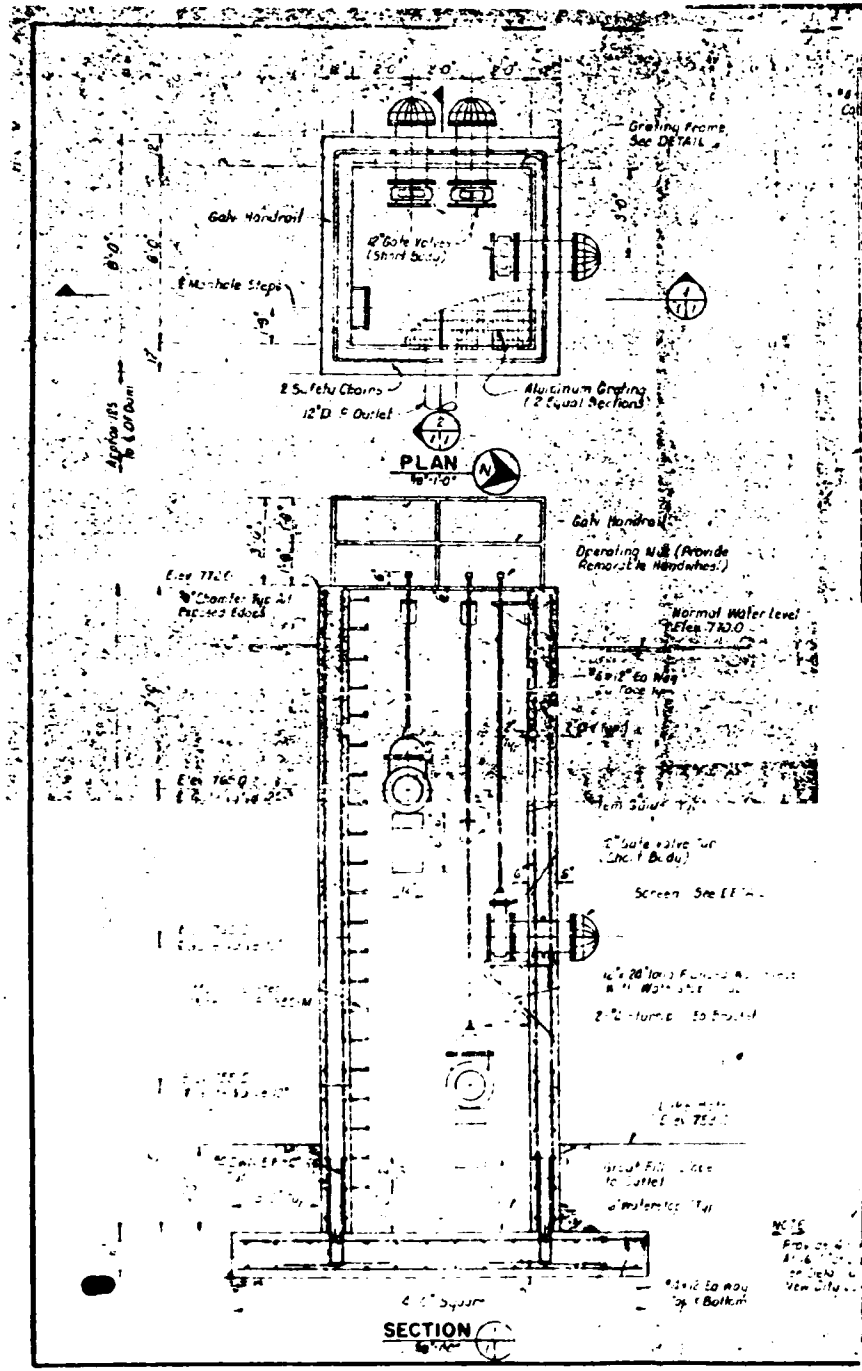
EARTH CROSS SECTIONS

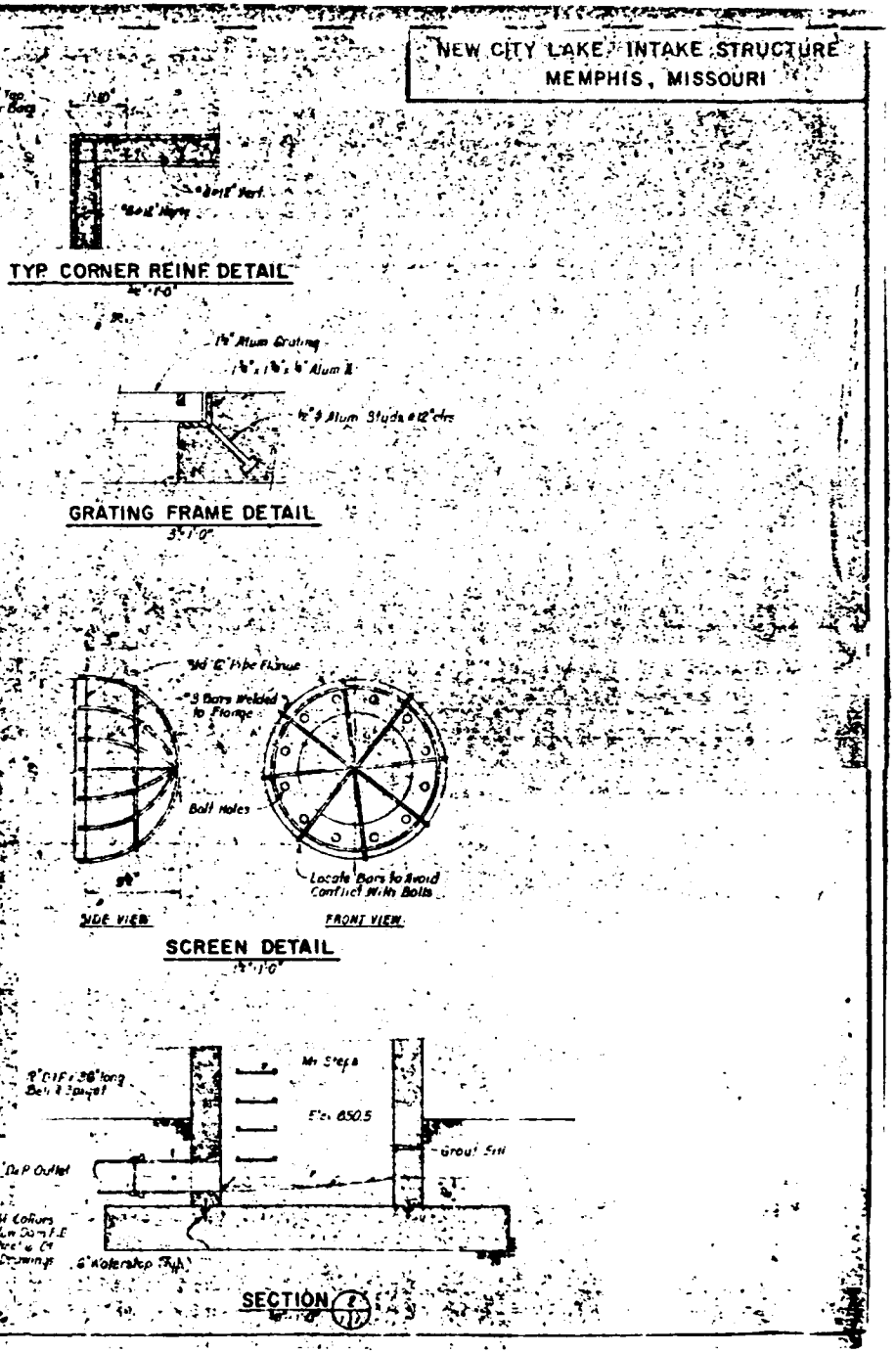

2
7
Consulting Engineers
Kansas City, Missouri
MEMPHIS, MISSOURI
NEW CITY LAKE
DAM & SPILLWAY PLAN
OUTLET DETAIL - OUTLET CONDUIT
OUTLET CONDUIT
DISSIPATOR CHANNEL
DAM AND SPILLWAY PLAN


SHEET 6 of 7
MEMPHIS, MISSOURI
NEW CITY LAKE
OUTLET CONDUIT, SERVICE SPILLWAY, & CUTOFF TRENCH DETAILS
DAM CROSS SECTION AT ℄ OF OUTLET CONDUIT
SERVICE SPILLWAY CONDUIT
CONDUIT CUTOFF COLLAR
CUTOFF TRENCH ALIGNMENT
TRENCH DETAIL - OUTLET CONDUIT
CHANNEL DETAIL AT OUTLET
SECTION A-A
SECTION B-B
DETAIL "A"
6


SERVICE SPILLWAY CONDUIT & PLUNGE POOL
DETAIL A
OUTLET CONNECTION
SERVICE SPILLWAY INLET STRUCTURE DETAIL
TRENCH DETAIL SERVICE SPILLWAY CONDUIT
GENERAL STRUCTURAL NOTES
SHEET 7 OF 7
MEMPHIS, MISSOURI
NEW CITY LAKE
SERVICE SPILLWAY DETAILS

NEW CITY LAKE, INTAKE STRUCTURE
MEMPHIS, MISSOURI



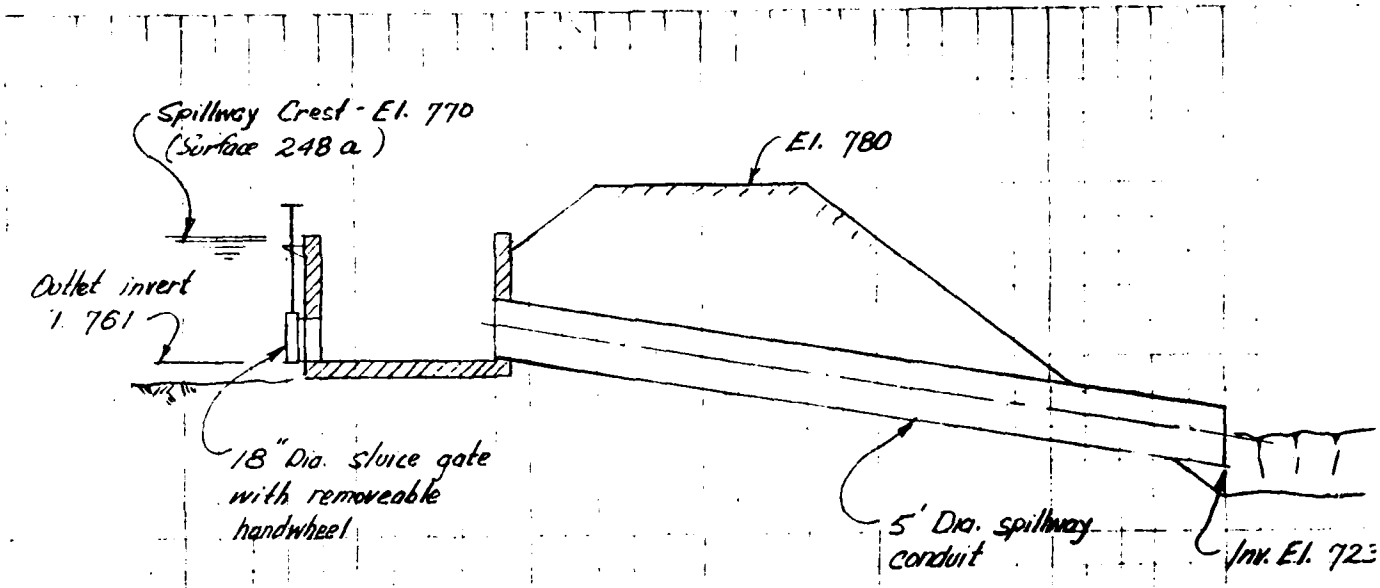


ENGINEERING CONSULTANTS, INC.

MEMPHIS NEW CITY LAKE - MISSOURI — SHEET NO. 1 OF

JOB NO. 1223

RATING CURVE FOR SPILLWAY AUXILIARY OUTLET — BY JCI DATE 10/13/78



Capacity for sluice gate in headwall is given by:

$Q = .7\ A\sqrt{2gh}$ $\quad A = 1.767\ ft^2$

$= .7\ (1.767)\sqrt{2gh}$

$= 9.9\sqrt{h}$

El. Ft	H. Ft	Q - CFS
765	3.25	17.8
767	5.25	22.7
769	7.25	26.7
770	8.25	28.4

Drawdown rate at design pool elevation.

Surface area = 248 a

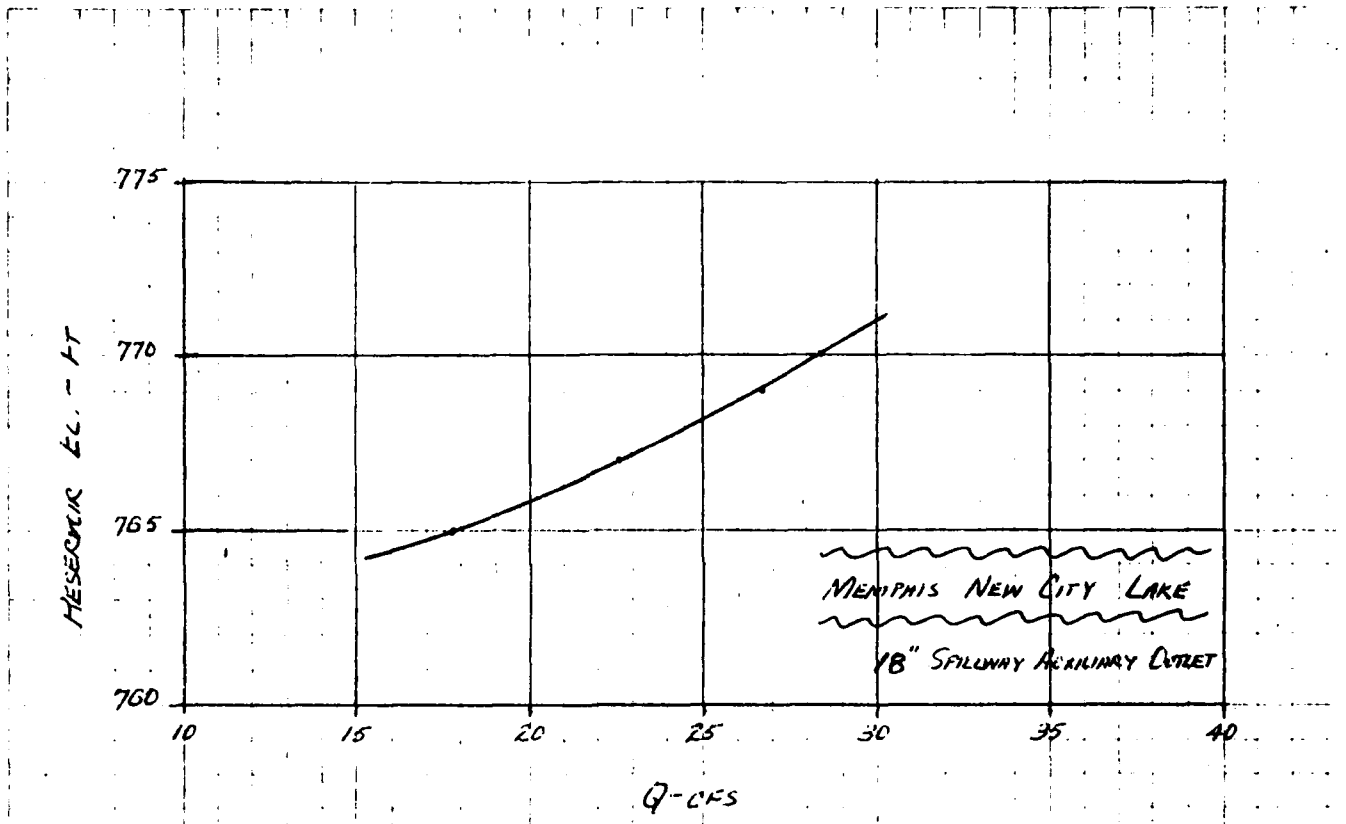
Time to drawdown one foot $= \frac{248 \times 43{,}560}{28.4 \times 60 \times 60 \times 24} = 4.4$ days

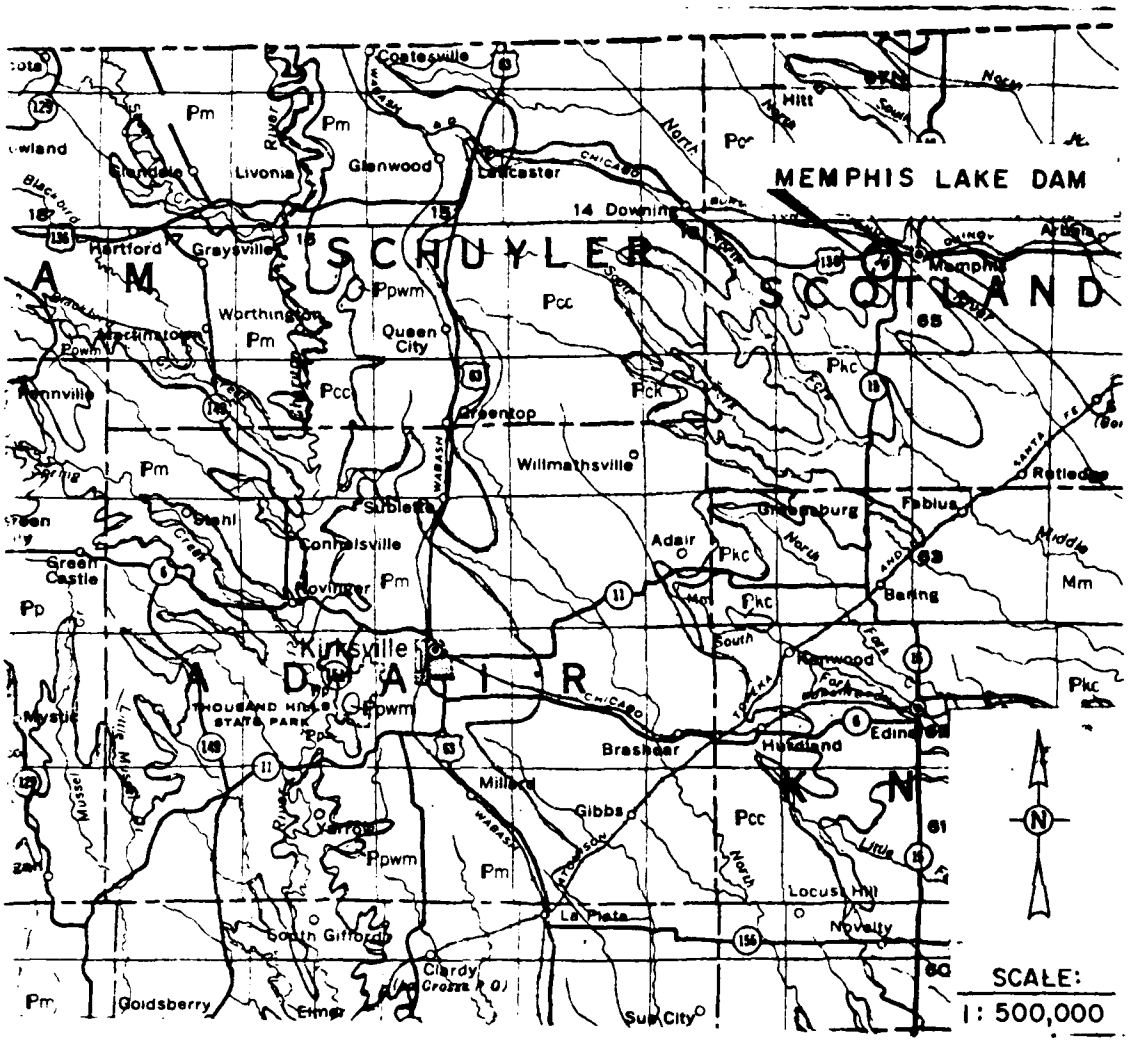
ENGINEERING CONSULTANTS, INC.

Memphis New City Lake - Missouri — SHEET NO. 2 OF

JOB NO. 1223

Rating Curve For Spillway Auxiliary Outlet — BY JCI DATE 10/13/71





Explanation

Pennsylvanian System

P_{kc} - Kansas City group: cyclic deposits with numerous limestones.
P_{pwm} - Pleasanton group: sandstone channel member.
P_{m} - Marmaton group: cyclic deposits with limestones.
P_{cc} - Cherokee group: cyclic deposits, predominately shale, sandstone and coal beds.

Mississippian System

M_{m} - sandy, oolitic, fossiliferous, lithographic, or cherty limestones.
M_{o} - cherty, crinoidal limestone, with some shale.
M_{k} - intercalated limestones and shales.

Reference: Geologic Map of Missouri, 1961, Division of Geological Survey and Water Resources, State of Missouri.

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

MEMPHIS LAKE AND PARK DAM

Photo 1 - View along crest of dam taken at left abutment.

Photo 2 - View of downstream slope of dam taken downstream of crest at right abutment.

Photo 3 - View of upstream slope of dam taken from slope at left abutment.

Photo 4 - Erosion gullies in downstream slope along left abutment contact.

Photo 5 - Picture of erosion gullies in downstream slope along left abutment contact.

Photo 6 - Picture of eroded material deposited at downstream end of erosion gullies.

Photo 7 - Picture of intake structure for water supply piping.

Photo 8 - Picture of drop inlet structure for service spillway.

Photo 9 - Picture of discharge end of 60-inch I.D. corrugated metal pipe used for service spillway.

Photo 10 - Close-up of discharge end of 60-inch I.D. corrugated metal pipe.

Photo 11 - View of discharge channel for service spillway.

Photo 12 - View of emergency spillway channel taken at left abutment of spillway.

Photo 13 - Picture of concrete weir located in emergencyu spillway channel.

Photo 14 - View of discharge channel of emergency spillway.

Photo 1 - View along crest of dam taken at left abutment.

Photo 2 - View of downstream slope of dam taken downstream of crest at right abutment.

Photo 3 - View of upstream slope of dam taken from slope at left abutment.

Photo 4 - Erosion gullies in downstream slope along left abutment contact.

Photo 5 - Picture of erosion gullies in downstream slope along left abutment contact.

Photo 6 - Picture of eroded material deposited at downstream end of erosion gullies.

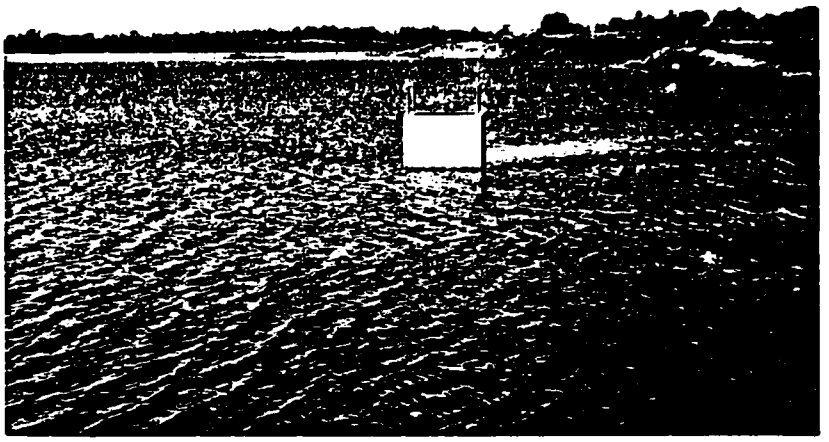


Photo 7 - Picture of intake structure for water supply piping.

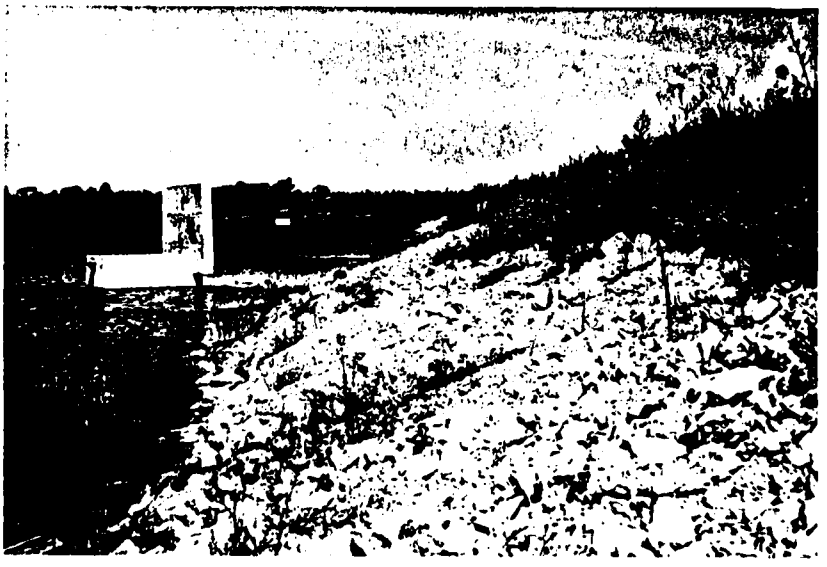


Photo 8 - Picture of drop inlet structure for service spillway.

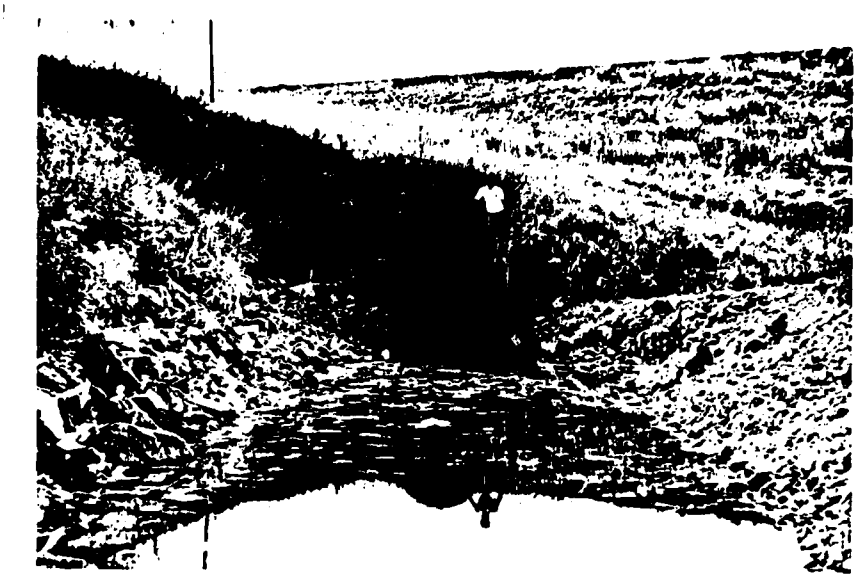


Photo 9 - Picture of discharge end of 60-inch I.D. corrugated metal pipe used for service spillway.

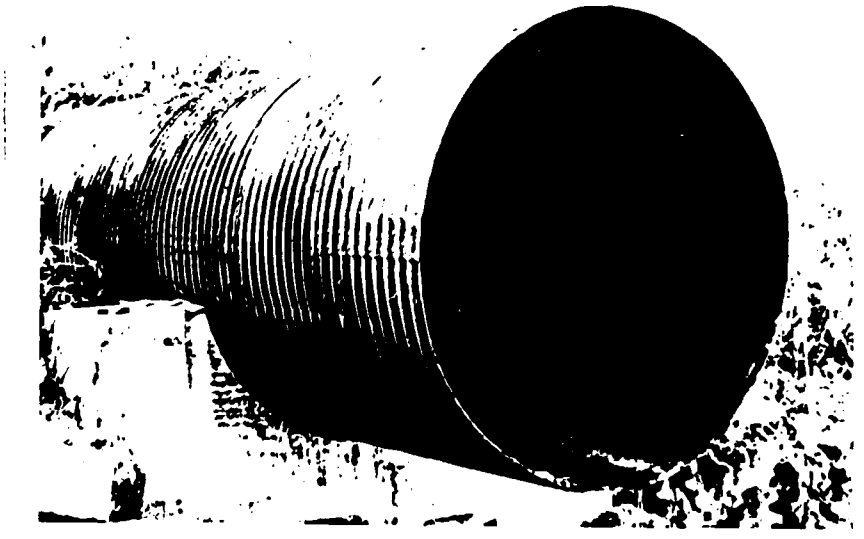


Photo 10 - Close-up of discharge end of 60-inch I.D. corrugated metal pipe.

Photo 11 - View of discharge channel for service spillway.

Photo 12 - View of emergency spillway channel taken at left abutment of spillway.

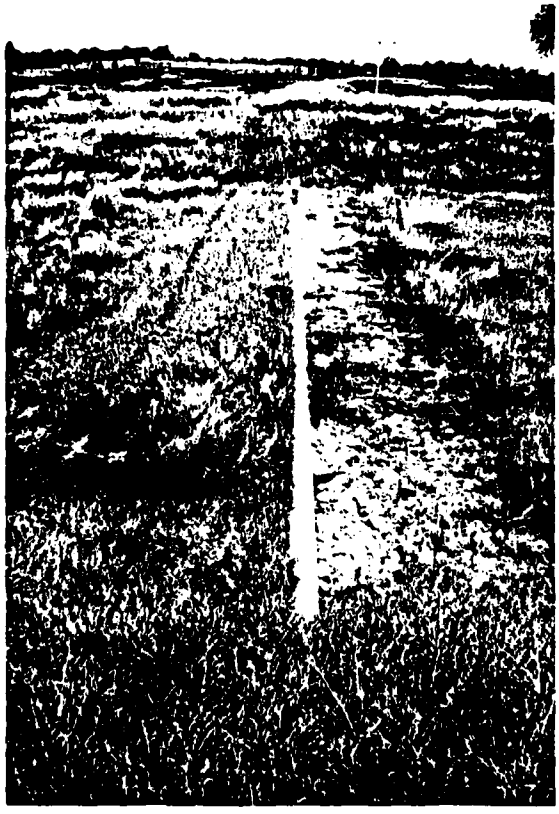
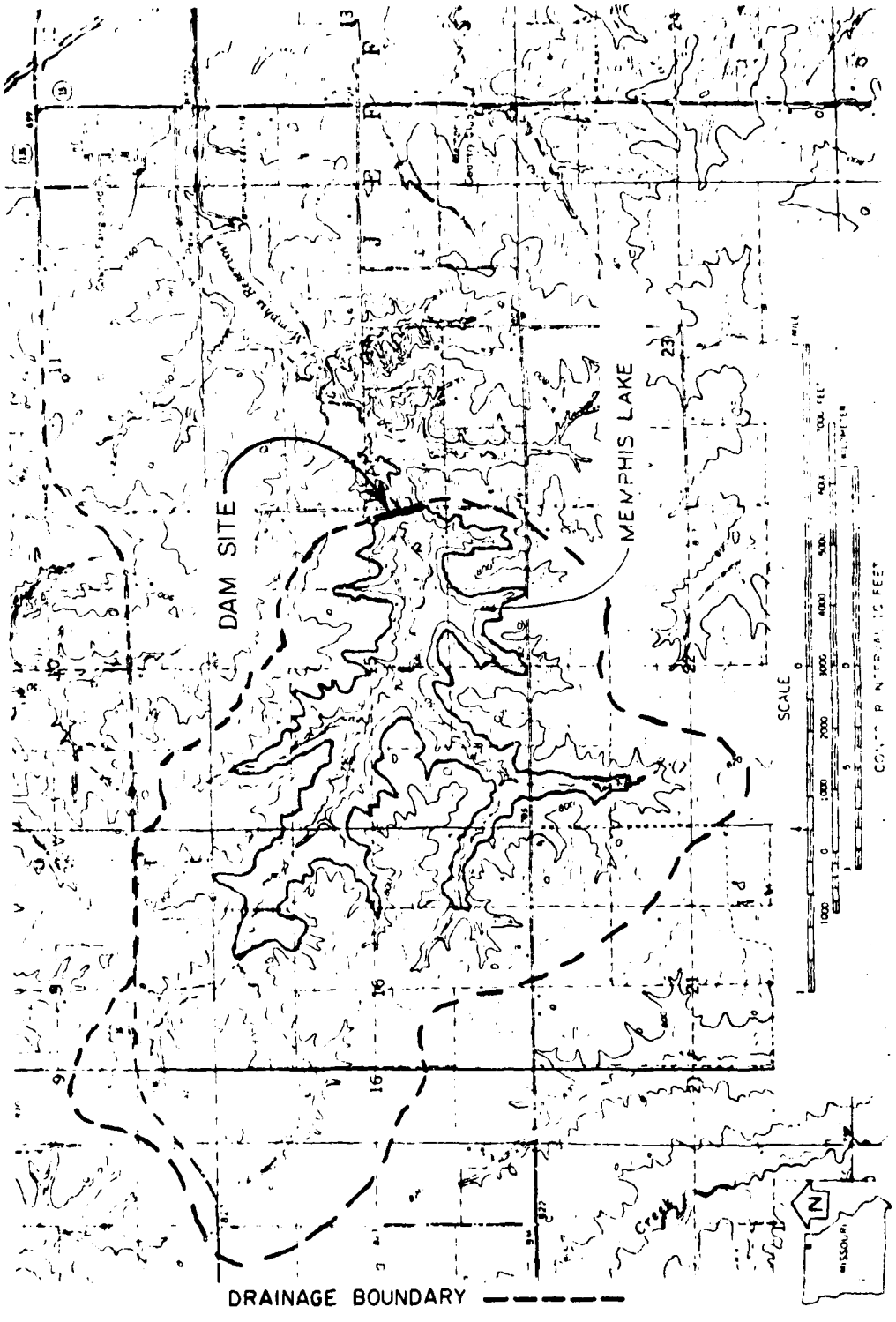


Photo 13 - Picture of concrete weir located in emergency spillway channel.

Photo 14 - View of discharge channel of emergency spillway.

APPENDIX B

HYDROLOGIC COMPUTATIONS



MEMPHIS LAKE AND PARK DAM
DRAINAGE AREA

ECI-4 ENGINEERING CONSULTANTS, INC.

D.S.M. SAFETY INSPECTION — MISSOURI SHEET NO. 1 OF .....
MEMPHIS LAKE & PARK DAM JOB NO. 1223-001-1
RESERVOIR AREA CAPACITY BY KLB DATE .....

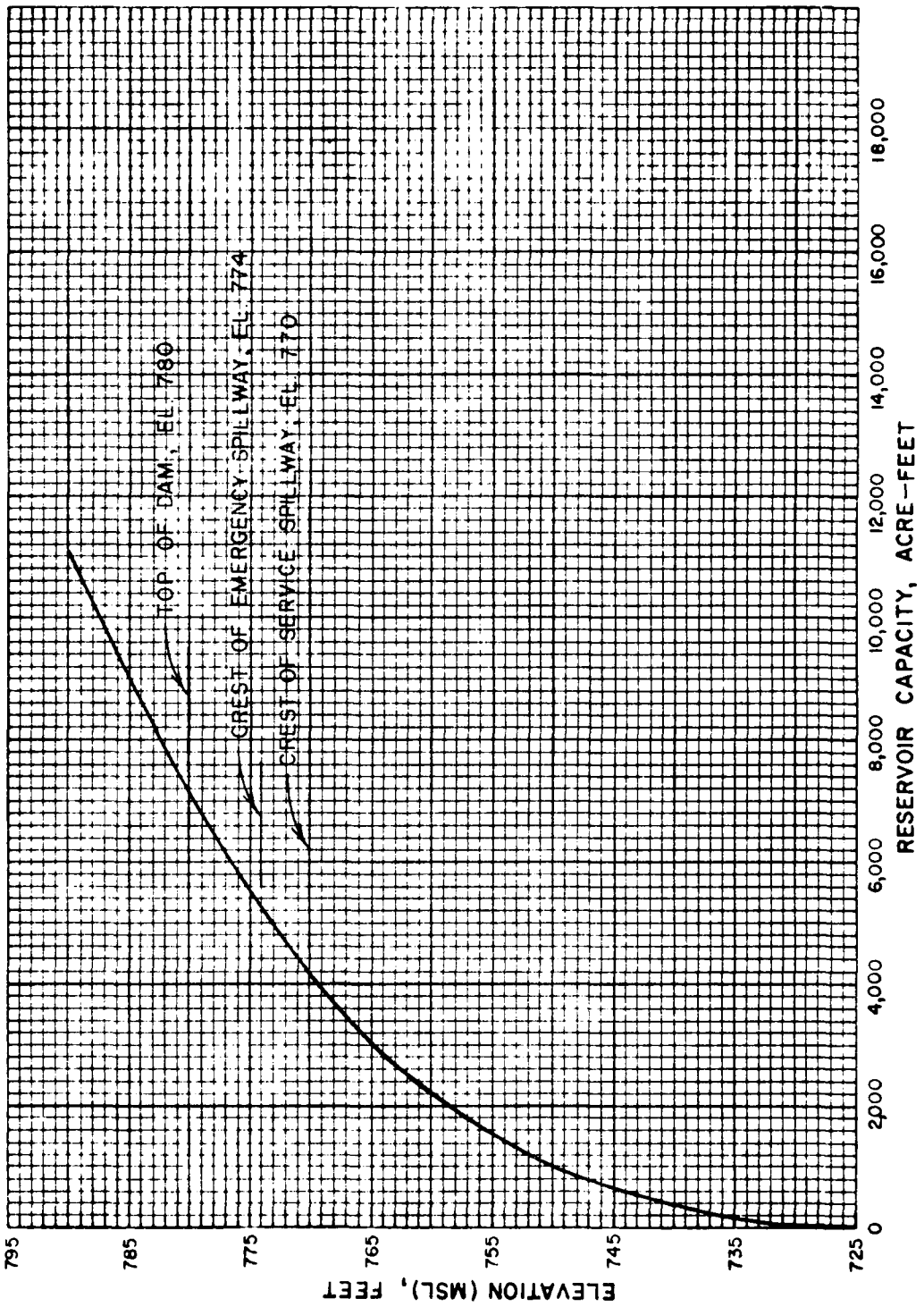
NEW CITY LAKE, MEMPHIS

AREA - CAPACITY CURVE

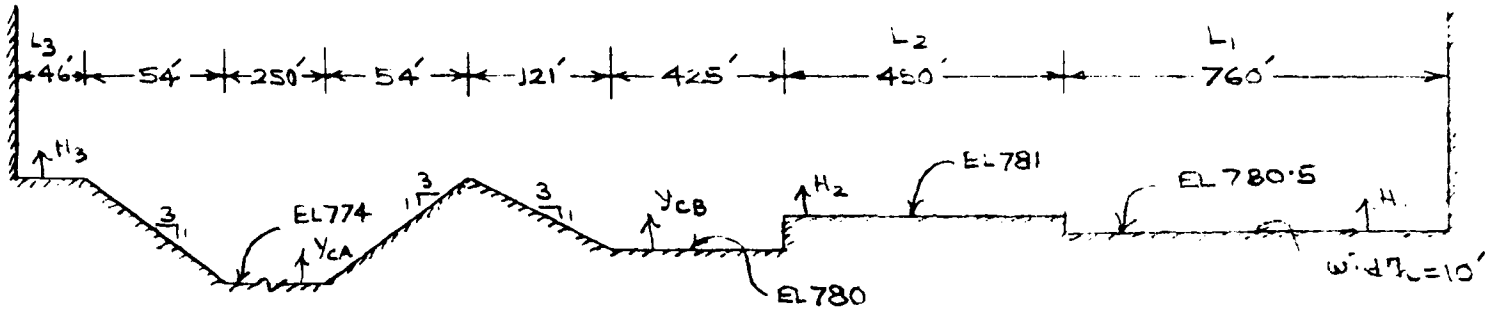
ELEV (FT) M.S.L.	SURFACE AREA (ACRES)	INCREMENTAL VOLUME (AC-FT)	TOTAL VOLUME (AC-FT)	REMARKS
725	0	0	0	
730	12.2	20.4	20.4	
740	43.9	280.6	301.1	
750	95.7	697.8	998.8	
760	139.4	1175.2	2174.0	
770	247.6	1934.9	4108.9	SERVICE SPILLWAY CREST
774	280.0*	1055	5164	EMERGENCY SPILLWAY CREST
780	342.0*	1866	7030	TOP OF DAM
790	445.0*	3935	10965	

* INTERPOLATED VALUES.

Data was also taken on the USGS Memphis Quadrangle (7.5 minute series) sheets in combination with data given in the National Inventory Table.



MEMPHIS LAKE & PARK DAM
RESERVOIR CAPACITY CURVE



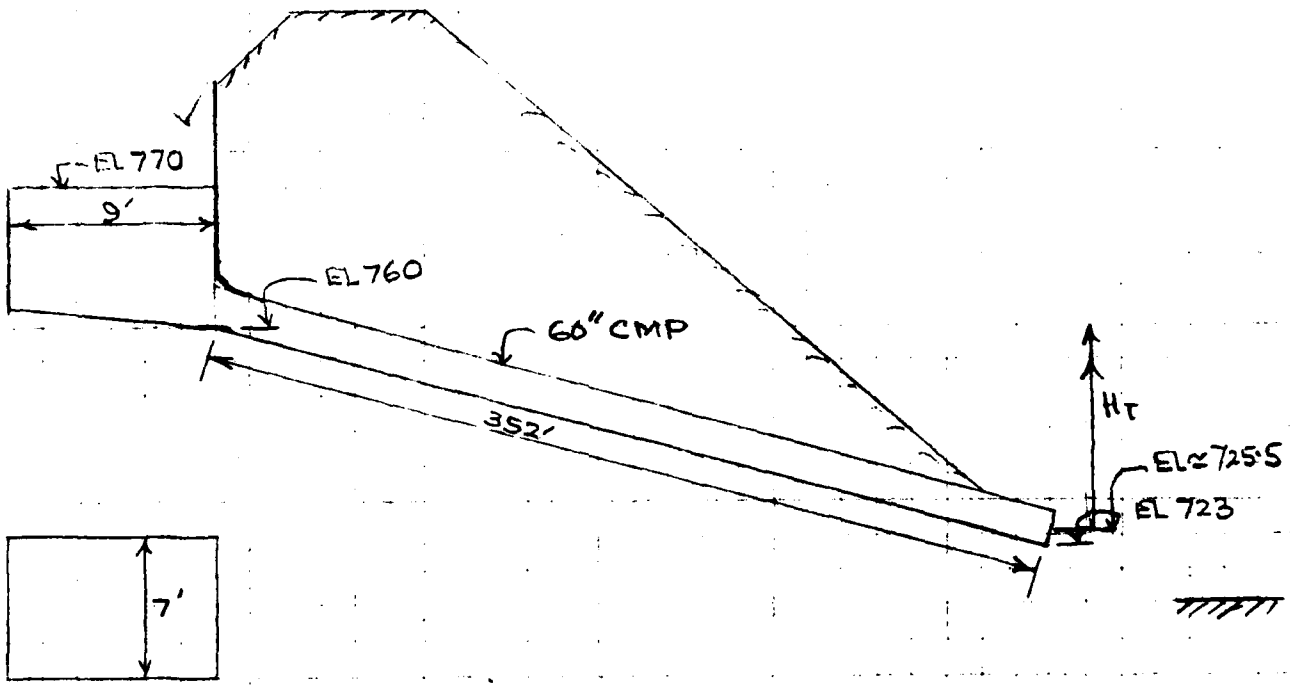
Y_{CA}	T_{CA}	A_{CA}	$V_{CA} = 5.67 \times \sqrt{\frac{A_{CA}}{T_{CA}}}$	$\frac{V_{CA}^2}{2g}$	Upstream W.S. Elev. $= 774 + Y_{CA} + \frac{V_{CA}^2}{2g}$	Q_{CA}	Y_{CB}	T_{CB}	A_{CB}	V_{CB}	Q_{CB}	H_1	L_1	C_1	H_2	L_2	C_2	W_3	L_3	C_3	$Q_T = Q_{CA} + Q_{CB} + C_1 L_1 H_1^{3/2} +$
1	256	253	5·64	0·49	775·49	1427															1427
2	262	512	7·93	0·98	776·98	4060															4060
3	268	777	9·65	1·45	778·45	7498															7498
4	274	1048	11·09	1·91	779·91	11,622															11,622
5	280	1325	12·33	2·36	781·36	16,337	0·91	427·73	387·99	5·4	2095	0·86	760	2·68	0·36	450	2·53				20,302
6	286	1608	13·44	2·81	782·81	21,611	1·88	430·64	804·3	7·75	6233	2·31	760	2·64	1·81	450	2·64				37,781
7	292	1897	14·45	3·24	784·24	27,412	2·84	433·52	1219·1	9·51	11,594	3·74	760	2·64	3·24	450	2·64				60,446

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF
MEMPHIS LAKE & PARK DAM — JOB NO. 1223-001
SERVICE SPILLWAY CAPACITY — BY JMAS DATE 10-17-78

MEMPHIS LAKE & PARK DAM

SERVICE SPILLWAY CAPACITY



Upstream W.S. Elev @ 771

a) Weir flow:

Assume $C = 3.5$

$Q_w = CL^{3/2} = 3.5 \times 25 \times 1^{3/2} = 88$ cfs

b) Pipe flow:

Assume $n = 0.024$ & $K_e = 0.5$

$$H_T = \left(1 + K_e + \frac{29 n^2 L}{R^{1.33}}\right)\frac{V^2}{2g}$$

$$= \left(1 + 0.5 + \frac{29 \times .024^2 \times 352}{1.25^{1.33}}\right)\frac{V^2}{2g}$$

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MS[illegible]
MEMPHIS LAKE & PARK DAM
SERVICE SPILLWAY CAPACITY

SHEET NO. 2 OF ____
JOB NO. 1223-001
BY MAS DATE 10-17-78

$$H_T = 5.87 \frac{V^2}{2g}$$

$$V = \frac{1}{\sqrt{5.87}} \sqrt{2g H_T} = 0.41 \sqrt{2g H_T}$$

$$\boxed{Q = 0.41 A \sqrt{2g H_T}}$$

$$Q = 0.41 \times .785 \times 5^2 \sqrt{64.4 \times 45.5}$$

$$= 436 \text{ cfs} > 88 \text{ cfs}$$

Actual $\underline{Q = 88 \text{ cfs}}$

Upstream W.S. Elev @ 772

a) Weir flow:

$$Q = CLH^{3/2} = 3.5 \times 25 \times 2^{1.5}$$

$$= \underline{247 \text{ cfs}}$$

b) Pipe flow > 247 cfs.

Actual $\underline{Q = 247 \text{ cfs}}$

Upstream W.S. Elev @ 773

a) Weir flow:

$$Q = CLH^{3/2} = 3.5 \times 25 \times 3^{1.5}$$

$$= 456 \text{ cfs}$$

b) Pipe flow:

$$Q = 0.41 A \sqrt{2g H_T} = 0.41 \times .785 \times 25 \sqrt{64.4 \times 47.5}$$

$Q = 445 <$ WEIR FLOW, ACTUAL $\underline{Q = 445 \text{ CFS}}$

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 3 OF
MEMPHIS LAKE AND PARK DAM — JOB NO. 1223-001-1
SERVICE SPILLWAY CAPACITY — BY KLB — DATE 10-17-78
WT

UPSTREAM WATER SURFACE ELEV AT 774

PIPE FLOW CONTROLS

$Q = 0.41 A \sqrt{2g H_T} = 0.41 \times .785 \times 25 \sqrt{64.4 \times 48.5}$

$Q = 450$ CFS

UPSTREAM WATER SURFACE ELEV AT 775.49

PIPE FLOW CONTROLS

$Q = 0.41 A \sqrt{2g H_T} = 0.41 \times .785 \times 25 \sqrt{64.4 \times 49.99}$

$Q = 457$ CFS.

UPSTREAM WATER SURFACE ELEV AT 776.96

PIPE FLOW CONTROLS

$Q = 0.41 A \sqrt{2g H_T} = 0.41 \times 0.785 \times 25 \sqrt{64.4 \times 51.46}$

$Q = 463.$ CFS

UPSTREAM WATER SURFACE ELEV AT 779.86

PIPE FLOW CONTROLS

$Q = 0.41 A \sqrt{2g H_T} = 0.41 \times 0.785 \times 25 \times \sqrt{64.4 \times 54.36}$

$Q = 476$ CFS

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 4 OF ____
MEMPHIS LAKE AND PARK DAM — JOB NO. 1223-001-1
SERVICE SPILLWAY CAPACITY — BY KLB — DATE 10-17-78
QF

UPSTREAM WATER SURFACE AT 781.29

PIPE FLOW CONTROLS

$Q = 0.41 A\sqrt{2g H_T} = 0.41 \times 0.785 \times 25 \times \sqrt{64.4 \times 55.29}$

$Q = 482$ CFS

UPSTREAM WATER SURFACE AT 782.71

PIPE FLOW CONTROLS

$Q = 0.41 A\sqrt{2g H_T} = 0.41 \times 0.785 \times 25 \times \sqrt{64.4 \times 57.21}$

$Q = 488$ CFS

UPSTREAM WATER SURFACE AT 784.11

PIPE FLOW CONTROLS

$Q = 0.41 A\sqrt{2g H_T} = 0.41 \times 0.785 \times 25 \times \sqrt{64.4 \times 58.61}$

$Q = 494$ CFS

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION -- MISSOURI
MEMPHIS LAKE AND PARK DAM
COMBINED SERVICE SPILLWAY EMERGENCY SPILLWAY AND OVERTOP DISCHARGE CAPACITY

SHEET NO. 1 OF ...
JOB NO. 17-73-001-1
BY KLB DATE 10-17-78

ELEV FT (M.S.L.)	SERVICE SPILLWAY DISCHARGE (CFS)	EMERGENCY SPILLWAY DISCHARGE (CFS)	OVERTOP DISCHARGE (CFS)	TOTAL DISCHARGE (CFS)	REMARKS
770	0	—	—	0	CREST ELEVATION, SERVICE SPILLWAY
771	88	—	—	88	
772	247	—	—	247	
773	445	—	—	445	
774	450	0	—	450	CREST ELEVATION, EMERGENCY SPILLWAY
775.49	457	860	—	1317	
776.96	463	2455	—	2918	
779.86	476	7089	0	7565	TOP OF DAM ELEV = 780
781.29	482	10016	3538	14036	
782.71	488	13306	15135	28929	
784.11	494	16950	29303	46747	

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI SHEET NO. 4 OF
MEMPHIS LAKE & PARK DAM JOB NO. 1223-001
COMBINED SPILLWAYS & OVERTOP DISCHARGE CAPACITY BY MAS DATE 12/19/78

Upstream W.S. Elev. (ft., MSL)	Service Spillway discharge (cfs.)	Emergency spillway & overtop discharge (cfs.)	Total discharge (cfs.)	Remarks
770	0	0	0	Crest of Service Spillway
771	88		88	
772	247		247	
773	445		445	
774	450		450	Crest of Emergency Spwy
775.49	457	1427	1884	
776.98	463	4060	4523	
778.45	470	7498	7,968	
779.91	476	11,622	12,098	
780			12,400	Top of dam
781.36	483	20,302	20,785	
782.81	489	37,781	38,270	
784.24	495	60,446	60,941	

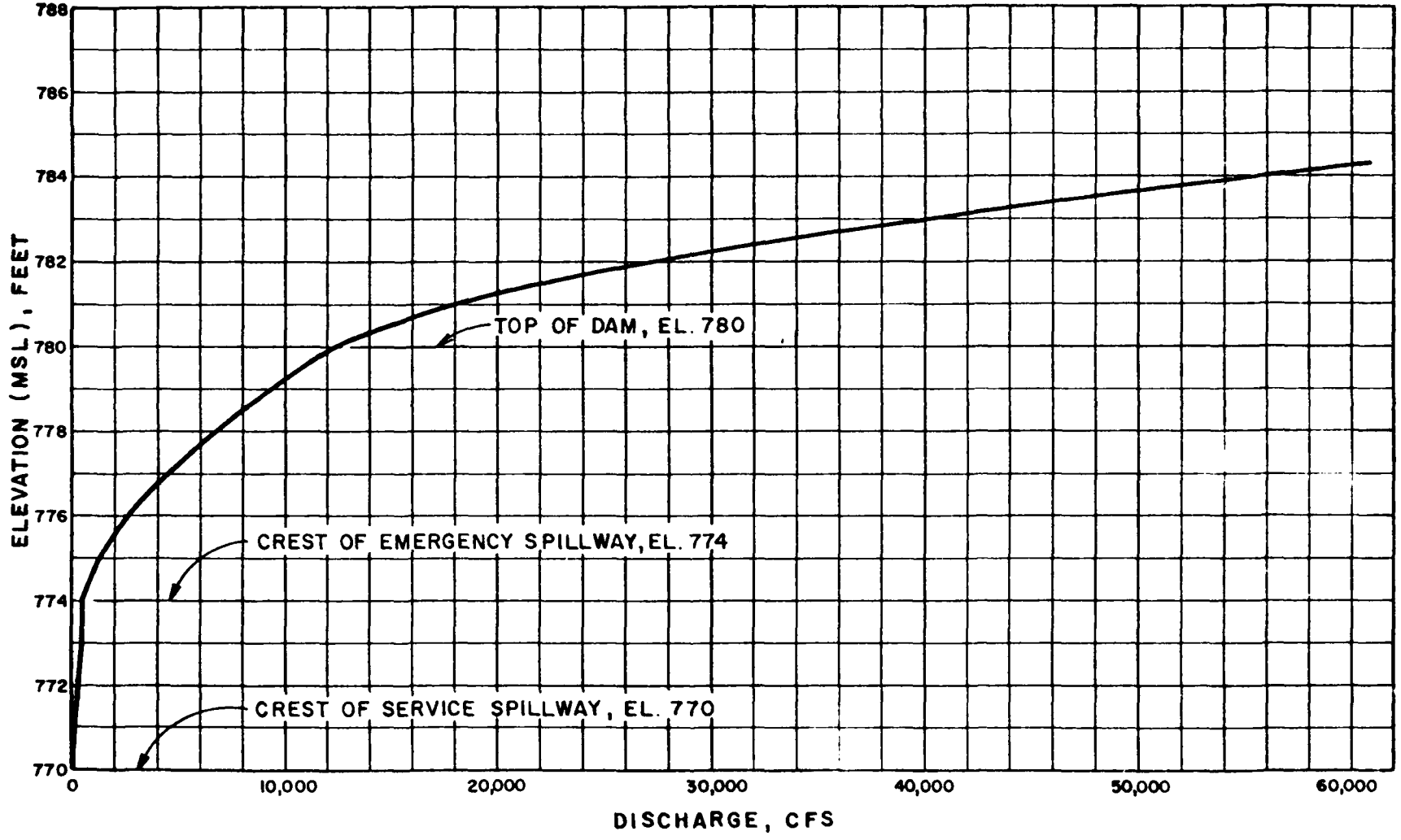
Upstream Water Surface Elev. @ 774

Pipe Flow Controls

$$Q = 0.41 A\sqrt{2gH_T} = 0.41 \times .785 \times 25\sqrt{64.4 \times 48.5}$$

$$= 450 \text{ cfs}$$

W.S. Elev (ft.)	H_T (ft.)	A (ft^2)	$Q = .41A\sqrt{2gH_T}$ cfs
775.49	49.99	19.63	457
776.98	51.48	19.63	463
778.45	52.95	19.63	470
779.91	54.41	19.63	476
781.36	55.86	19.63	483
782.81	57.31	19.63	489
784.24	58.74	19.63	495



MEMPHIS LAKE & PARK DAM
COMBINED SPILLWAYS & OVERTOP RATING CURVE

[illegible] CONSULTING, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 1 OF
MEMPHIS LAKE AND PARK DAM — JOB NO. 1223-001-1
UNIT HYDROGRAPH PARAMETERS — BY KLB DATE 10-4-78

1. DRAINAGE AREA = 1950 ACRES = 3.05 SQ. MI.

2. LENGTH OF STREAM $L = (24'' \times 2000') / 5280' = 0.91$ MI

3. DIFFERENCE IN ELEVATION. ΔH

$\Delta H = 827 - 770 = 57'$

4. TIME OF CONCENTRATION

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385}$$

$$T_c = \left(\frac{11.9 \times 0.91^3}{57}\right)^{0.385}$$

$T_c = 0.49$ HR

5. LAG TIME $L_t = 0.6 \times T_c$

$L_t = 0.6 \times 0.49 = 0.29$ HR

6. RAINFALL UNIT DURATION D

$$D \leq \frac{L_t}{3} = \frac{.29}{3} = 0.096$$

USE $D = 0.083$ HR = 5 MIN.

7. TIME TO PEAK, T_p

$$T_p = \frac{D}{2} + 0.6 \times T_c$$

$$T_p = \frac{0.083}{2} + 0.6 \times 0.49 = 0.34 \text{ HR}$$

8. $q_p = \frac{484\ A}{T_p} = \frac{484 \times 3.05}{0.34} = 4341.76$ CFS

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 2 OF ____

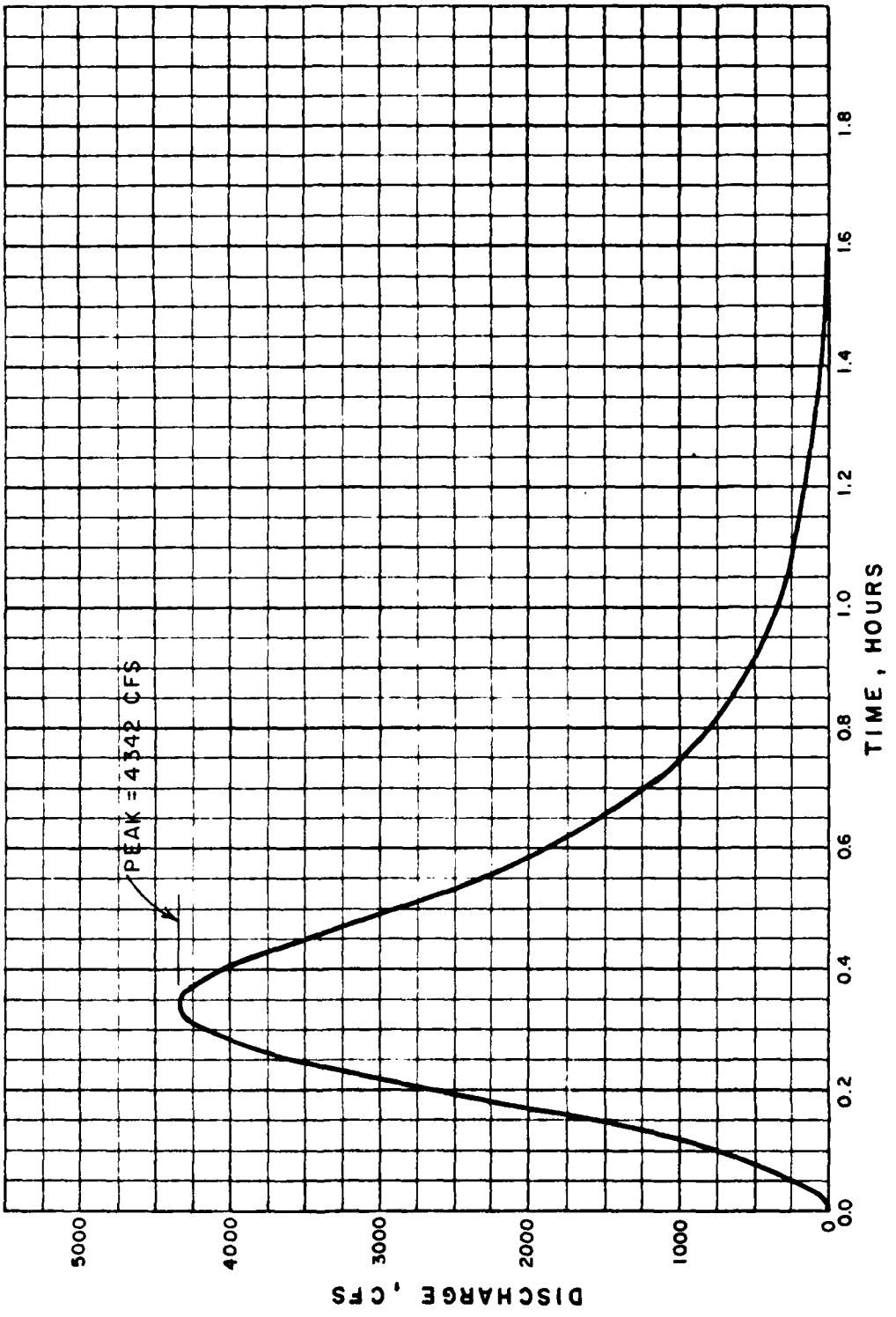
MEMPHIS LAKE AND PARK DAM — JOB NO. 1223-001-1

UNIT HYDROGRAPH PARAMETERS — BY MLB DATE 10-3-78

9) CURVILINEAR UNIT HYDROGRAPH

TIME T/T_p	DISCHARGE RATIO q/q_p	UNIT HYDROGRAPH	
		TIME, T (HRS)	DISCHARGE (CFS)
0.0	0.000	0.00	0.00
0.1	0.015	0.03	65.13
0.2	0.075	0.07	325.63
0.3	0.16	0.10	694.68
0.4	0.28	0.14	1215.69
0.5	0.45	0.17	1953.79
0.6	0.60	0.20	2605.06
0.7	0.77	0.24	3343.16
0.8	0.89	0.27	3864.17
0.9	0.97	0.31	4211.51
1.0	1.00	0.34	4341.76
1.1	0.98	0.37	4254.93
1.2	0.92	0.41	3994.42
1.3	0.84	0.44	3647.08
1.4	0.75	0.48	3256.32
1.5	0.66	0.51	2865.56
1.6	0.56	0.54	2431.39
1.8	0.42	0.61	1823.54
2.0	0.32	0.68	1389.36
2.2	0.24	0.75	1042.02
2.4	0.18	0.82	781.52
2.6	0.13	0.88	564.43
2.8	0.098	0.95	425.49
3.0	0.075	1.02	325.63
3.5	0.036	1.19	156.30
4.0	0.018	1.36	78.15
4.5	0.009	1.53	39.08
5.0	0.004	1.70	17.37

1968.57 CFS HR.



MEMPHIS LAKE AND PARK DAM
5 MINUTE UNIT HYDROGRAPH

DETERMINATION OF PMS

1. Determine drainage area of the basin

   D.A. = 3.05 sq. mi.

2. Determine PMP Index rainfall :

   Location of centroid of basin:

   Long. 92.24°; Lat.: 40.44°

   → PMP for 200 sq. mi. & 24 hrs duration

   = 23.8" (from Fig 1, HMR No 33)

3. Determine basin rainfall interms of percentage of PMP Index rainfall for various durations;

   Location: Long. 92.24°; Lat. 40.44°

   ⇒ Zone 7

Duration (Hrs.)	Percent of Index rainfall (%)	Total rainfall (Inches)	Rainfall increments (Inches)	Duration of increment (Hrs.)
6	100	23.8	23.8	6
12	120	28.6	4.8	6
24	130	30.9	2.3	12

MEMPHIS LAKE & PARK DAM

100-YEAR FLOOD BY REGRESSION EQUATION

Regression equation for 100-year flood for Missouri:

$$Q_{100} = 85.1 A^{0.934} S^{0.576}$$

where

A = drainage area in sq. mi.

S = main channel slope, ft./mi. (Avg. slope between 0.1L & 0.85L)

For Memphis Lake & Park Dam:

A = 3.05 sq. mi

S = 27 ft./0.68 mi = 39.71 ft/mi.

$$Q_{100} = (85.1)(3.05)^{0.934(3.05)^{-0.02}}(39.71)^{0.576}$$

$$= \underline{1965 \text{ cfs}}$$

HEC1DB INPUT DATA

```
**************************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION        JULY 1978
  LAST MODIFICATION  21 AUG 78
**************************************

A                                DAM SAFETY INSPECTION - MISSOURI
A                                  MEMPHIS [illegible] LAKE AND PARK DAM
A                          PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
B     300       0       5       0       0       0       0       0       0       0
B1      5
J       1       2       1
J1    1.0     0.5
K       0       3                                       1
K1        INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH
M       1      -1    3.05            3.05     1.0
P           23.80     100     120     130
T                                                    0.85    0.0?
U      22
UI    9.0    440.   1800.   3920.   4342.   3920.   2940.   2100.   1450.   1020.
UI   700.    520.    360.    260.    170.    130.    100.     70.     50.     30.
UI    10.      0.
X              0.       1
K       1       3                       2               1
K1        ROUTE HYDROGRAPH THROUGH MEMPHIS CITY LAKE AND PARK DAM
Y                               1       1
Y1      1                                           -770.      -1
Y4    770     771     772     773     774  775.49  776.98  778.45  779.91  780.00
Y4781.36  782.81  784.24
Y5      0      88     247     ???     450    1884    4253    7968   12098   12400
Y5  20785   38270   60941
$S     0.    20.4   301.1   998.?  2174.0  4108.9  5164.0  7030.0 10965.0
$E   725.    730.    740.    750.    760.    770.    774.    780.    790.
$$770.00
$D780.00
K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 3
ROUTE HYDROGRAPH TO 3
END OF NETWORK

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  21 AUG 78
**********************************

RUN  DATE= 78/12/18.
     TIME= 14.05.54.
```

DAM SAFETY INSPECTION - MISSOURI
MEMPHIS [redacted] LAKE AND PARK DAM
PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NW	NMIN	MIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0

JOPER	NRT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 RATIO= 2 LRTIO= 1

RTIOS= 1.00 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNI

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	3.05	0.00	3.05	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.80	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.85	.07	0.00	0.00

GIVEN UNIT GRAPH, NUHGS= 22

0.	440.	1800.	3520.	4342.	3920.	2940.	2100.	1450.	1020.
700.	520.	380.	260.	170.	130.	100.	70.	50.	30.
10.	0.								

UNIT GRAPH TOTALS 23932. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.20	.19	.01	3689.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.20	.19	.01	3903.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.20	.19	.01	4155.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.20	.19	.01	4290.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.20	.19	.01	4382.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.20	.19	.01	4451.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.24	.23	.01	4498.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.24	.23	.01	4550.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.24	.23	.01	4884.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.24	.23	.01	4801.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.24	.23	.01	4986.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.30	162	.24	.23	.01	5151.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.35	163	.24	.23	.01	5274.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.40	164	.24	.23	.01	5362.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.45	165	.24	.23	.01	5421.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.50	166	.24	.23	.01	5461.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.55	167	.24	.23	.01	5489.
1.01	1.30	18	.01	0.00	.01	0.	1.01	14.00	168	.24	.23	.01	5509.
1.01	1.35	19	.01	0.00	.01	0.	1.01	14.05	169	.30	.29	.01	5524.
1.01	1.40	20	.01	0.00	.01	0.	1.01	14.10	170	.30	.29	.01	5560.
1.01	1.45	21	.01	0.00	.01	0.	1.01	14.15	171	.30	.29	.01	5674.
1.01	1.50	22	.01	0.00	.01	0.	1.01	14.20	172	.30	.29	.01	5889.
1.01	1.55	23	.01	0.00	.01	0.	1.01	14.25	173	.30	.29	.01	6151.
1.01	2.00	24	.01	0.00	.01	0.	1.01	14.30	174	.30	.29	.01	6387.
1.01	2.05	25	.01	0.00	.01	0.	1.01	14.35	175	.30	.29	.01	6564.
1.01	2.10	26	.01	0.00	.01	0.	1.01	14.40	176	.30	.29	.01	6690.
1.01	2.15	27	.01	0.00	.01	0.	1.01	14.45	177	.30	.29	.01	6777.
1.01	2.20	28	.01	0.00	.01	0.	1.01	14.50	178	.30	.29	.01	6837.
1.01	2.25	29	.01	0.00	.01	0.	1.01	14.55	179	.30	.29	.01	6879.
1.01	2.30	30	.01	0.00	.01	0.	1.01	15.00	180	.30	.29	.01	6910.
1.01	2.35	31	.01	0.00	.01	0.	1.01	15.05	181	.18	.18	.01	6931.
1.01	2.40	32	.01	0.00	.01	0.	1.01	15.10	182	.36	.36	.01	6896.
1.01	2.45	33	.01	0.00	.01	0.	1.01	15.15	183	.36	.36	.01	6775.
1.01	2.50	34	.01	0.00	.01	0.	1.01	15.20	184	.54	.54	.01	6608.
1.01	2.55	35	.01	0.00	.01	0.	1.01	15.25	185	.63	.63	.01	6914.
1.01	3.00	36	.01	0.00	.01	0.	1.01	15.30	186	1.53	1.53	.01	7612.
1.01	3.05	37	.01	0.00	.01	0.	1.01	15.35	187	2.53	2.53	.01	9178.
1.01	3.10	38	.01	0.00	.01	0.	1.01	15.40	188	.99	.99	.01	12636.
1.01	3.15	39	.01	0.00	.01	0.	1.01	15.45	189	.63	.63	.01	18287.
1.01	3.20	40	.01	0.00	.01	0.	1.01	15.50	190	.54	.54	.01	23779.
1.01	3.25	41	.01	0.00	.01	0.	1.01	15.55	191	.36	.36	.01	26290.
1.01	3.30	42	.01	0.00	.01	0.	1.01	16.00	192	.36	.36	.01	25175.
1.01	3.35	43	.01	0.00	.01	0.	1.01	16.05	193	.28	.27	.01	22125.
1.01	3.40	44	.01	0.00	.01	0.	1.01	16.10	194	.28	.27	.01	18775.
1.01	3.45	45	.01	0.00	.01	0.	1.01	16.15	195	.28	.27	.01	15741.
1.01	3.50	46	.01	0.00	.01	0.	1.01	16.20	196	.28	.27	.01	13286.
1.01	3.55	47	.01	0.00	.01	0.	1.01	16.25	197	.28	.27	.01	11335.
1.01	4.00	48	.01	0.00	.01	0.	1.01	16.30	198	.28	.27	.01	9856.
1.01	4.05	49	.01	0.00	.01	0.	1.01	16.35	199	.28	.27	.01	8640.
1.01	4.10	50	.01	0.00	.01	0.	1.01	16.40	200	.28	.27	.01	8222.
1.01	4.15	51	.01	0.00	.01	0.	1.01	16.45	201	.28	.27	.01	7709.
1.01	4.20	52	.01	0.00	.01	0.	1.01	16.50	202	.28	.27	.01	7378.
1.01	4.25	53	.01	0.00	.01	0.	1.01	16.55	203	.28	.27	.01	7142.
1.01	4.30	54	.01	0.00	.01	0.	1.01	17.00	204	.28	.27	.01	6959.
1.01	4.35	55	.01	0.00	.01	0.	1.01	17.05	205	.22	.21	.01	6816.
1.01	4.40	56	.01	0.00	.01	0.	1.01	17.10	206	.22	.21	.01	6672.
1.01	4.45	57	.01	0.00	.01	0.	1.01	17.15	207	.22	.21	.01	6472.
1.01	4.50	58	.01	0.00	.01	0.	1.01	17.20	208	.22	.21	.01	6208.
1.01	4.55	59	.01	0.00	.01	0.	1.01	17.25	209	.22	.21	.01	5880.
1.01	5.00	60	.01	0.00	.01	0.	1.01	17.30	210	.22	.21	.01	5481.

1.01	5.05	61	.01	0.00	.01	0.	1.01	17.35	211	.02	.01	.01	5904.
1.01	5.10	62	.01	0.00	.01	0.	1.01	17.40	212	.02	.01	.01	5974.
1.01	5.15	63	.01	0.00	.01	0.	1.01	17.45	213	.02	.01	.01	5965.
1.01	5.20	64	.01	0.00	.01	0.	1.01	17.50	214	.02	.01	.01	5928.
1.01	5.25	65	.01	.01	.01	0.	1.01	17.55	215	.02	.01	.01	5863.
1.01	5.30	66	.01	.01	.01	2.	1.01	18.00	216	.02	.01	.01	5758.
1.01	5.35	67	.01	.01	.01	13.	1.01	18.05	217	.02	.01	.01	5630.
1.01	5.40	68	.01	.01	.01	35.	1.01	18.10	218	.02	.01	.01	5428.
1.01	5.45	69	.01	.01	.01	65.	1.01	18.15	219	.02	.01	.01	5160.
1.01	5.50	70	.01	.01	.01	95.	1.01	18.20	220	.02	.01	.01	4955.
1.01	5.55	71	.01	.01	.01	119.	1.01	18.25	221	.02	.01	.01	4808.
1.01	6.00	72	.01	.01	.01	136.	1.01	18.30	222	.02	.01	.01	4706.
1.01	6.05	73	.07	.06	.01	148.	1.01	18.35	223	.02	.01	.01	4636.
1.01	6.10	74	.07	.06	.01	180.	1.01	18.40	224	.02	.01	.01	4588.
1.01	6.15	75	.07	.06	.01	281.	1.01	18.45	225	.02	.01	.01	4555.
1.01	6.20	76	.07	.06	.01	472.	1.01	18.50	226	.02	.01	.01	4532.
1.01	6.25	77	.07	.06	.01	704.	1.01	18.55	227	.02	.01	.01	4516.
1.01	6.30	78	.07	.06	.01	914.	1.01	19.00	228	.02	.01	.01	4505.
1.01	6.35	79	.07	.06	.01	1071.	1.01	19.05	229	.02	.01	.01	4498.
1.01	6.40	80	.07	.06	.01	1183.	1.01	19.10	230	.02	.01	.01	4493.
1.01	6.45	81	.07	.06	.01	1260.	1.01	19.15	231	.02	.01	.01	4490.
1.01	6.50	82	.07	.06	.01	1315.	1.01	19.20	232	.02	.01	.01	4487.
1.01	6.55	83	.07	.06	.01	1352.	1.01	19.25	233	.02	.01	.01	4487.
1.01	7.00	84	.07	.06	.01	1380.	1.01	19.30	234	.02	.01	.01	4483.
1.01	7.05	85	.07	.06	.01	1399.	1.01	19.35	235	.02	.01	.01	4482.
1.01	7.10	86	.07	.06	.01	1413.	1.01	19.40	236	.02	.01	.01	4337.
1.01	7.15	87	.07	.06	.01	1422.	1.01	19.45	237	.02	.01	.01	4335.
1.01	7.20	88	.07	.06	.01	1429.	1.01	19.50	238	.02	.01	.01	4335.
1.01	7.25	89	.07	.06	.01	1434.	1.01	19.55	239	.02	.01	.01	4335.
1.01	7.30	90	.07	.06	.01	1438.	1.01	20.00	240	.02	.01	.01	4335.
1.01	7.35	91	.07	.06	.01	1440.	1.01	20.05	241	.02	.01	.01	4335.
1.01	7.40	92	.07	.06	.01	1442.	1.01	20.10	242	.02	.01	.01	4335.
1.01	7.45	93	.07	.06	.01	1443.	1.01	20.15	243	.02	.01	.01	4335.
1.01	7.50	94	.07	.06	.01	1443.	1.01	20.20	244	.02	.01	.01	4335.
1.01	7.55	95	.07	.06	.01	1443.	1.01	20.25	245	.02	.01	.01	4335.
1.01	8.00	96	.07	.06	.01	1443.	1.01	20.30	246	.02	.01	.01	4335.
1.01	8.05	97	.07	.06	.01	1443.	1.01	20.35	247	.02	.01	.01	4335.
1.01	8.10	98	.07	.06	.01	1443.	1.01	20.40	248	.02	.01	.01	4335.
1.01	8.15	99	.07	.06	.01	1443.	1.01	20.45	249	.02	.01	.01	4335.
1.01	8.20	100	.07	.06	.01	1443.	1.01	20.50	250	.02	.01	.01	4335.
1.01	8.25	101	.07	.06	.01	1443.	1.01	20.55	251	.02	.01	.01	4335.
1.01	8.30	102	.07	.06	.01	1443.	1.01	21.00	252	.02	.01	.01	4335.
1.01	8.35	103	.07	.06	.01	1443.	1.01	21.05	253	.02	.01	.01	4335.
1.01	8.40	104	.07	.06	.01	1443.	1.01	21.10	254	.02	.01	.01	4335.
1.01	8.45	105	.07	.06	.01	1443.	1.01	21.15	255	.02	.01	.01	4335.
1.01	8.50	106	.07	.06	.01	1443.	1.01	21.20	256	.02	.01	.01	4335.
1.01	8.55	107	.07	.06	.01	1443.	1.01	21.25	257	.02	.01	.01	4335.
1.01	9.00	108	.07	.06	.01	1443.	1.01	21.30	258	.02	.01	.01	4335.
1.01	9.05	109	.07	.06	.01	1443.	1.01	21.35	259	.02	.01	.01	4335.
1.01	9.10	110	.07	.06	.01	1443.	1.01	21.40	260	.02	.01	.01	4335.
1.01	9.15	111	.07	.06	.01	1443.	1.01	21.45	261	.02	.01	.01	4335.
1.01	9.20	112	.07	.06	.01	1443.	1.01	21.50	262	.02	.01	.01	4335.
1.01	9.25	113	.07	.06	.01	1443.	1.01	21.55	263	.02	.01	.01	4335.
1.01	9.30	114	.07	.06	.01	1443.	1.01	22.00	264	.02	.01	.01	4335.
1.01	9.35	115	.07	.06	.01	1443.	1.01	22.05	265	.02	.01	.01	4335.
1.01	9.40	116	.07	.06	.01	1443.	1.01	22.10	266	.02	.01	.01	4335.
1.01	9.45	117	.07	.06	.01	1443.	1.01	22.15	267	.02	.01	.01	4335.
1.01	9.50	118	.07	.06	.01	1443.	1.01	22.20	268	.02	.01	.01	4335.
1.01	9.55	119	.07	.06	.01	1443.	1.01	22.25	269	.02	.01	.01	4335.
1.01	10.00	120	.07	.06	.01	1443.	1.01	22.30	270	.02	.01	.01	4335.

1.01	10.05	121	.07	.06	.01	1443.	1.01	22.35	271	.02	.01	.01	335.
1.01	10.10	122	.07	.06	.01	1443.	1.01	22.40	272	.02	.01	.01	335.
1.01	10.15	123	.07	.06	.01	1443.	1.01	22.45	273	.02	.01	.01	335.
1.01	10.20	124	.07	.06	.01	1443.	1.01	22.50	274	.02	.01	.01	335.
1.01	10.25	125	.07	.06	.01	1443.	1.01	22.55	275	.02	.01	.01	335.
1.01	10.30	126	.07	.06	.01	1443.	1.01	23.00	276	.02	.01	.01	335.
1.01	10.35	127	.07	.06	.01	1443.	1.01	23.05	277	.02	.01	.01	335.
1.01	10.40	128	.07	.06	.01	1443.	1.01	23.10	278	.02	.01	.01	335.
1.01	10.45	129	.07	.06	.01	1443.	1.01	23.15	279	.02	.01	.01	335.
1.01	10.50	130	.07	.06	.01	1443.	1.01	23.20	280	.02	.01	.01	335.
1.01	10.55	131	.07	.06	.01	1443.	1.01	23.25	281	.02	.01	.01	335.
1.01	11.00	132	.07	.06	.01	1443.	1.01	23.30	282	.02	.01	.01	335.
1.01	11.05	133	.07	.06	.01	1443.	1.01	23.35	283	.02	.01	.01	335.
1.01	11.10	134	.07	.06	.01	1443.	1.01	23.40	284	.02	.01	.01	335.
1.01	11.15	135	.07	.06	.01	1443.	1.01	23.45	285	.02	.01	.01	335.
1.01	11.20	136	.07	.06	.01	1443.	1.01	23.50	286	.02	.01	.01	335.
1.01	11.25	137	.07	.06	.01	1443.	1.01	23.55	287	.02	.01	.01	335.
1.01	11.30	138	.07	.06	.01	1443.	1.02	0.00	288	.02	.01	.01	335.
1.01	11.35	139	.07	.06	.01	1443.	1.02	.05	289	0.00	0.00	0.00	329.
1.01	11.40	140	.07	.06	.01	1443.	1.02	.10	29	0.00	0.00	0.00	329.
1.01	11.45	141	.07	.06	.01	1443.	1.02	.15	291	0.00	0.00	0.00	304.
1.01	11.50	142	.07	.06	.01	1443.	1.02	.20	292	0.00	0.00	0.00	294.
1.01	11.55	143	.07	.06	.01	1443.	1.02	.25	293	0.00	0.00	0.00	194.
1.01	12.00	144	.07	.06	.01	1443.	1.02	.30	294	0.00	0.00	0.00	139.
1.01	12.05	145	.20	.19	.01	1443.	1.02	.35	295	0.00	0.00	0.00	98.
1.01	12.10	146	.20	.19	.01	1501.	1.02	.40	296	0.00	0.00	0.00	88.
1.01	12.15	147	.20	.19	.01	1739.	1.02	.45	297	0.00	0.00	0.00	48.
1.01	12.20	148	.20	.19	.01	2204.	1.02	.50	298	0.00	0.00	0.00	34.
1.01	12.25	149	.20	.19	.01	2778.	1.02	.55	299	0.00	0.00	0.00	20.
1.01	12.30	150	.20	.19	.01	3297.	1.02	1.00	300	0.00	0.00	0.00	17.
									SUM	30.94	28.79	2.15	688871.
										(786.)(	731.)(	55.)(	19508.65)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26290.	7654.	2392.	2296.	688842.
CMS	744.	217.	68.	65.	19506.
INCHES		23.34	29.18	29.18	29.18
MM		592.93	741.16	741.16	741.16
AC-FT		3795.	4744.	4744.	4744.
THOUS CU M		4681.	5852.	5852.	5852.

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	2.	13.	35.	65.	95.
119.	136.	148.	180.	281.	472.	704.	916.	1071.	1183.
1260.	1315.	1352.	1380.	1399.	1413.	1422.	1429.	1436.	1438.
1440.	1442.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.
1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.	1443.
1443.	1443.	1443.	1443.	1443.	1501.	1739.	2204.	2778.	3297.

3685.	3903.	4159.	4290.	4382.	4451.	4498.	4550.	4644.	4801.
4986.	5151.	5274.	5362.	5421.	5461.	5489.	5509.	5524.	5560.
5674.	5889.	6151.	6367.	6564.	6690.	6777.	6837.	6879.	6910.
6931.	6896.	6775.	6698.	6914.	7612.	9178.	12636.	18247.	23779.
26290.	25175.	22185.	18775.	15781.	13256.	11335.	9956.	8940.	8222.
7709.	7378.	7142.	6955.	6816.	6672.	6472.	6208.	5926.	5681.
5500.	5372.	5285.	5224.	5183.	5152.	5130.	5028.	4660.	3995.
3088.	2306.	1720.	1302.	1013.	811.	672.	567.	498.	446.
412.	387.	367.	353.	343.	337.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	335.
335.	335.	335.	335.	335.	335.	335.	335.	335.	329.
304.	254.	194.	139.	98.	68.	48.	34.	24.	17.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	26290.	7654.	2392.	2296.	688842.
CMS	744.	217.	68.	65.	19506.
INCHES		23.34	29.18	29.18	29.18
MM		592.93	741.16	741.16	741.16
AC-FT		3795.	4744.	4744.	4744.
THOUS CU M		4681.	5852.	5852.	5852.

HYDROGRAPH AT STA 3 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	6.	18.	33.	48.
60.	68.	74.	90.	141.	236.	352.	457.	535.	591.
630.	657.	676.	695.	700.	706.	711.	714.	717.	719.
720.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	721.	721.	721.	721.	721.
721.	721.	721.	721.	721.	750.	869.	1102.	1384.	1648.
1843.	1981.	2077.	2145.	2191.	2225.	2249.	2275.	2322.	2401.
2493.	2576.	2637.	2681.	2710.	2731.	2744.	2755.	2762.	2780.
2837.	2944.	3075.	3193.	3282.	3345.	3388.	3419.	3440.	3495.
3466.	3408.	3388.	3349.	3457.	3806.	4589.	6318.	9124.	11889.
13145.	12587.	11063.	9387.	7870.	6628.	5667.	4978.	4470.	4111.
3859.	3689.	3571.	3477.	3408.	3336.	3236.	3104.	2963.	2840.
2790.	2686.	2683.	2612.	2591.	2576.	2565.	2514.	2330.	1971.
1544.	1153.	860.	651.	507.	406.	336.	285.	249.	223.
206.	193.	183.	176.	171.	169.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
108.	127.	97.	69.	49.	34.	24.	17.	12.	8.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13145.	3827.	1196.	1140.	344421.

PMF FLOOD ROUTING

CMS	372.	108.	34.	33.	4753.
INCHES		11.67	14.59	14.59	14.59
MM		296.46	370.58	370.58	370.58
AC-FT		189.	2372.	2372.	2372.
THOUS CU M		2341.	2926.	2926.	2926.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH MEMPHIS CITY LAKE AND PARK DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-779.	-1

STAGE	770.0	771.0	772.0	773.0	774.0	775.5	777.0	778.5	779.9	780.8
	781.0	782.8	784.2							
FLOW	0.	88.	247.	445.	450.	1884.	4253.	7969.	12098.	12400.
	21745.	38277.	60901.							
CAPACITY=	0.	20.	301.	999.	2174.	4109.	5164.	7030.	10965.	
ELEVATION=	725.	730.	740.	750.	760.	770.	774.	780.	790.	

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
770.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
780.0	0.0	0.0	0.

STATION 3, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	2.	2.	3.	4.	6.	8.	11.
14.	17.	20.	23.	26.	29.	32.	36.	39.	42.
45.	48.	52.	55.	58.	61.	64.	67.	71.	74.
77.	80.	83.	86.	90.	96.	102.	107.	113.	118.
124.	129.	135.	140.	145.	151.	156.	162.	167.	172.
177.	183.	188.	193.	198.	203.	208.	214.	219.	224.
229.	234.	239.	244.	249.	255.	262.	268.	274.	280.

286.	292.	298.	303.	309.	319.	322.	331.	342.	356.
372.	390.	409.	428.	449.	446.	448.	447.	447.	480.
448.	449.	460.	482.	586.	688.	789.	889.	986.	1088.
1178.	1275.	1375.	1478.	1584.	1690.	1796.	1913.	2008.	2251.
2412.	2568.	2716.	2855.	2992.	3139.	3321.	3564.	3994.	4772.
5875.	6956.	7865.	8618.	9142.	9460.	9639.	9701.	9685.	9618.
9518.	9398.	9268.	9133.	8997.	8860.	8721.	8576.	8424.	8265.
8102.	7943.	7801.	7662.	7528.	7400.	7277.	7157.	7031.	6883.
6709.	6482.	6239.	5981.	5719.	5457.	5200.	4951.	4710.	4480.
4259.	4125.	3994.	3868.	3746.	3628.	3515.	3405.	3298.	3196.
3097.	3001.	2909.	2820.	2734.	2651.	2571.	2493.	2419.	2347.
2277.	2210.	2145.	2082.	2022.	1964.	1907.	1865.	1833.	1801.
1770.	1740.	1710.	1681.	1653.	1625.	1598.	1571.	1549.	1520.
1495.	1470.	1446.	1423.	1400.	1378.	1356.	1334.	1313.	1292.
1272.	1252.	1233.	1214.	1196.	1177.	1160.	1142.	1125.	1109.
1092.	1075.	1057.	1038.	1019.	999.	979.	959.	940.	920.

STORAGE

4104.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4104.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4110.
4111.	4112.	4113.	4114.	4115.	4118.	4122.	4127.	4134.	4142.
4150.	4159.	4168.	4177.	4187.	4196.	4206.	4215.	4225.	4235.
4244.	4254.	4263.	4273.	4282.	4292.	4302.	4311.	4320.	4330.
4339.	4349.	4358.	4367.	4377.	4386.	4395.	4405.	4414.	4423.
4432.	4441.	4450.	4459.	4468.	4477.	4486.	4495.	4503.	4512.
4521.	4530.	4538.	4547.	4555.	4564.	4573.	4581.	4589.	4598.
4606.	4615.	4623.	4631.	4639.	4648.	4656.	4664.	4672.	4680.
4688.	4696.	4704.	4712.	4720.	4728.	4736.	4748.	4763.	4781.
4803.	4826.	4852.	4878.	4905.	4932.	4960.	4988.	5016.	5046.
5076.	5106.	5141.	5174.	5208.	5241.	5274.	5306.	5337.	5368.
5399.	5431.	5463.	5496.	5530.	5565.	5599.	5633.	5667.	5699.
5731.	5761.	5790.	5817.	5844.	5873.	5909.	5960.	6040.	6155.
6290.	6423.	6535.	6619.	6677.	6713.	6732.	6738.	6737.	6729.
6718.	6705.	6691.	6676.	6661.	6646.	6631.	6615.	6598.	6581.
6563.	6545.	6527.	6510.	6494.	6478.	6463.	6448.	6433.	6418.
6392.	6365.	6335.	6303.	6271.	6239.	6207.	6177.	6147.	6119.
6092.	6065.	6040.	6015.	5992.	5969.	5946.	5925.	5904.	5884.
5865.	5846.	5828.	5810.	5794.	5777.	5762.	5747.	5732.	5718.
5704.	5691.	5678.	5666.	5654.	5643.	5632.	5621.	5611.	5601.
5591.	5581.	5571.	5562.	5553.	5544.	5535.	5528.	5518.	5510.
5502.	5494.	5486.	5478.	5471.	5464.	5457.	5450.	5443.	5436.
5430.	5423.	5417.	5411.	5405.	5399.	5393.	5388.	5382.	5377.
5371.	5366.	5360.	5354.	5348.	5341.	5335.	5329.	5322.	5316.

STAGE

770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.1	770.1	770.1
770.2	770.2	770.2	770.3	770.3	770.3	770.4	770.4	770.4	770.5
770.5	770.5	770.6	770.6	770.7	770.7	770.7	770.8	770.8	770.8

770.9	770.9	770.9	771.0	771.0	771.1	771.1	771.1	771.2	771.2
771.2	771.3	771.3	771.3	771.4	771.4	771.4	771.5	771.5	771.5
771.6	771.6	771.6	771.7	771.7	771.7	771.8	771.8	771.8	771.8
771.9	771.8	771.9	772.0	772.0	772.0	771.9	772.1	772.1	772.2
772.2	772.2	772.3	772.5	772.3	772.3	772.1	772.4	772.5	772.5
772.6	772.7	772.8	772.9	773.0	773.1	772.4	773.2	773.4	773.6
773.3	773.8	773.9	774.0	774.1	774.2	773.2	773.3	774.6	774.7
774.8	774.9	775.0	775.1	775.2	775.3	774.4	774.5	775.5	775.7
775.8	775.9	776.0	776.1	776.2	776.3	775.4	775.5	776.6	776.8
777.6	778.0	778.4	778.7	778.9	779.0	776.4	776.6	778.1	779.1
779.0	779.0	778.9	778.9	778.8	778.8	779.0	779.1	778.7	778.6
778.5	778.4	778.4	778.3	778.3	778.2	778.7	778.2	778.1	778.1
777.9	777.9	777.8	777.9	777.6	777.5	778.2	777.4	777.3	777.2
777.0	776.9	776.8	776.7	776.7	776.6	777.4	776.5	776.4	776.4
776.3	776.2	776.1	776.1	776.0	776.0	776.5	775.9	775.9	775.8
775.7	775.7	775.7	775.6	775.6	775.5	775.9	775.5	775.5	775.8
775.4	775.3	775.3	775.3	775.2	775.2	775.2	775.2	775.2	775.1
775.1	775.1	775.0	775.0	775.0	775.0	774.9	774.9	774.9	774.9
774.9	774.8	774.8	774.8	774.8	774.8	774.7	774.7	774.7	774.7
774.7	774.6	774.6	774.6	774.6	774.6	774.5	774.5	774.5	774.5

PEAK OUTFLOW IS 9701. AT TIME 16.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	9701.	5658.	1783.	1712.	513571.
CMS	275.	160.	50.	48.	14543.
INCHES		17.26	21.76	21.76	21.76
MM		438.31	552.58	552.58	552.58
AC-FT		2808.	3537.	3537.	3537.
THOUS CU M		3461.	4363.	4363.	4363.

ONE-HALF PMF FLOOD ROUTING

60UN6

STATION 3, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	2.	3.	4.	[illegible]
7.	8.	10.	11.	13.	15.	16.	18.	19.	21.
23.	24.	26.	27.	29.	31.	32.	34.	35.	37.
38.	40.	42.	43.	45.	46.	48.	49.	51.	52.
54.	55.	57.	59.	60.	62.	63.	65.	66.	68.
69.	71.	72.	74.	75.	77.	78.	80.	81.	82.
84.	85.	87.	89.	91.	94.	96.	99.	102.	104.
107.	109.	112.	114.	117.	119.	122.	126.	130.	136.
143.	150.	158.	166.	174.	183.	191.	200.	209.	217.
227.	236.	246.	258.	271.	284.	296.	309.	321.	334.
347.	360.	374.	388.	403.	418.	433.	445.	445.	[illegible]
446.	447.	447.	447.	448.	448.	449.	449.	499.	710.
959.	1210.	1434.	1620.	1767.	1883.	2030.	2144.	2233.	2304.
2362.	2411.	2453.	2490.	2523.	2553.	2578.	2599.	2614.	2624.
2630.	2633.	2634.	2633.	2632.	2631.	2629.	2626.	2618.	2602.
2573.	2531.	2478.	2419.	2355.	2289.	2223.	2157.	2091.	2027.
1964.	1903.	1860.	1824.	1789.	1755.	1722.	1689.	1657.	1625.
1595.	1565.	1535.	1506.	1478.	1450.	1423.	1397.	1371.	1346.
1321.	1296.	1273.	1249.	1227.	1204.	1182.	1161.	1140.	1119.
1099.	1080.	1061.	1042.	1023.	1005.	988.	970.	953.	937.
921.	905.	889.	874.	859.	844.	830.	816.	802.	789.
776.	763.	751.	738.	726.	714.	703.	692.	681.	670.
659.	648.	637.	625.	613.	601.	589.	577.	565.	553.

STORAGE

4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.	4109.
4110.	4110.	4111.	4111.	4112.	4113.	4115.	4118.	4122.	4125.
4130.	4134.	4138.	4143.	4148.	4153.	4157.	4162.	4167.	4172.
4177.	4181.	4186.	4191.	4196.	4200.	4205.	4210.	4215.	4219.
4224.	4229.	4233.	4238.	4243.	4247.	4252.	4257.	4261.	4266.
4271.	4275.	4280.	4284.	4289.	4293.	4298.	4303.	4307.	4312.
4316.	4321.	4325.	4329.	4334.	4338.	4343.	4347.	4352.	4356.
4360.	4365.	4369.	4374.	4378.	4382.	4387.	4391.	4395.	4399.
4404.	4408.	4412.	4416.	4420.	4425.	4429.	4435.	4443.	4453.
[illegible]	4476.	4489.	4502.	4516.	4530.	4544.	4558.	4573.	4587.
4603.	4619.	4635.	4652.	4668.	4685.	4702.	4719.	4736.	4752.
4769.	4787.	4805.	4824.	4844.	4864.	4884.	4904.	4925.	4946.
4966.	4987.	5007.	5027.	5048.	5070.	5096.	5130.	5180.	5248.
5329.	5410.	5482.	5542.	5590.	5627.	5656.	5678.	5696.	5710.
5721.	5731.	5739.	5746.	5752.	5758.	5763.	5767.	5770.	5772.

5775.	5775.	5774.	5774.	5774.	5773.	5773.	5772.	5771.	5768.
5762.	5754.	5744.	5732.	5719.	5707.	5694.	5681.	5668.	5655.
5643.	5631.	5620.	5608.	5597.	5586.	5575.	5564.	5553.	5543.
5534.	5524.	5515.	5505.	5496.	5487.	5479.	5470.	5462.	5453.
5445.	5438.	5430.	5422.	5415.	5408.	5401.	5394.	5387.	5380.
5374.	5368.	5361.	5355.	5349.	5343.	5338.	5332.	5327.	5321.
5316.	5311.	5306.	5301.	5296.	5291.	5287.	5282.	5278.	5274.
5269.	5265.	5261.	5257.	5253.	5249.	5246.	5242.	5239.	5235.
5232.	5228.	5224.	5221.	5217.	5213.	5209.	5205.	5201.	5197.

STAGE

770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0
770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.0	770.1
770.1	770.1	770.1	770.1	770.1	770.2	770.2	770.2	770.2	770.2
770.3	770.3	770.3	770.3	770.3	770.3	770.4	770.4	770.4	770.4
770.4	770.5	770.5	770.5	770.5	770.5	770.5	770.6	770.6	770.6
770.6	770.6	770.6	770.7	770.7	770.7	770.7	770.7	770.8	770.8
770.8	770.8	770.8	770.8	770.9	770.9	770.9	770.9	770.9	770.9
771.0	771.0	771.0	771.0	771.0	771.0	771.1	771.1	771.1	771.1
771.1	771	771.1	771.2	771.2	771.2	771.2	771.2	771.3	771.3
771.3	771.4	771.4	771.5	771.5	771.6	771.6	771.7	771.8	771.8
771.8	771.9	772.0	772.1	772.1	772.2	772.2	772.3	772.4	772.4
772.5	772.6	772.6	772.7	772.8	772.9	772.9	773.0	773.1	773.2
773.3	773.3	773.4	773.5	773.6	773.6	773.7	773.9	774.1	774.3
774.5	774.8	775.0	775.2	775.4	775.5	775.6	775.7	775.7	775.8
775.8	775.8	775.8	775.9	775.9	775.9	775.9	775.9	775.9	776.0
776.0	776.0	776.0	776.0	776.0	776.0	776.0	776.0	776.0	775.9
775.9	775.9	775.9	775.8	775.8	775.7	775.7	775.7	775.6	775.6
775.5	775.5	775.5	775.4	775.4	775.4	775.3	775.3	775.3	775.2
775.2	775.2	775.1	775.1	775.1	775.0	775.0	775.0	775.0	774.9
774.9	774.9	774.9	774.8	774.8	774.8	774.8	774.7	774.7	774.7
774.7	774.7	774.6	774.6	774.6	774.6	774.6	774.5	774.5	774.5
774.5	774.5	774.5	774.4	774.4	774.4	774.4	774.4	774.4	774.4
774.3	774.3	774.3	774.3	774.3	774.3	774.3	774.3	774.2	774.2
774.2	774.2	774.2	774.2	774.2	774.2	774.1	774.1	774.1	774.1

PEAK OUTFLOW IS 2634. AT TIME 17.75 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2634.	1931.	647.	621.	186345.
CMS	75.	55.	18.	18.	5277.
INCHES		5.89	7.89	7.89	7.89
MM		149.62	200.50	200.50	200.50
AC-FT		958.	1283.	1283.	1283.
THOUS CU M		1181.	1583.	1583.	1583.

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	1	3.05	1	26290.	13145.
	(	7.90)	(	744.44)(	372.22)(
ROUTED TO	1	3.05	1	9701.	2634.
	(	7.90)	(	274.69)(	74.58)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	770.00	770.	780.00
STORAGE	4109.	4109.	7030.
OUTFLOW	0.	0.	12400.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	779.66	0.00	6748.	9701.	0.00	16.50	0.00
.50	775.98	.	5774.	2634.	0.00	17.75	0.00


DAT
ILM